



Simultaneous Subtraction of MWD and SRME

NZ 3D Processing

03 February 2021

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Passion for Geoscience

1. Convert to CGG internal format
2. Nav merge / trace edit
3. Low cut filter
4. Time Variant Scaling (TVS) & Resample to 4ms
5. Swell noise attenuation (SNA)
6. Debubble
7. Linear noise attenuation (LNA)
8. Tidal statics correction
9. Water column statics correction
10. Shot & channel scaling
11. Receiver motion correction (RMC)
12. Joint Deghost & Designature
13. Residual Bubble Removal
14. Source Sensor Datum Correction
15. Shallow Water Demultiple
16. Surface Related Multiple Elimination (3D SRME)
17. Simultaneous Subtraction of MWD & SRME

- **Objective:**

To remove free surface related multiple.

- **Procedure:**

Subtract MWD & SRME models from input seismic to achieve multiple free seismic data.

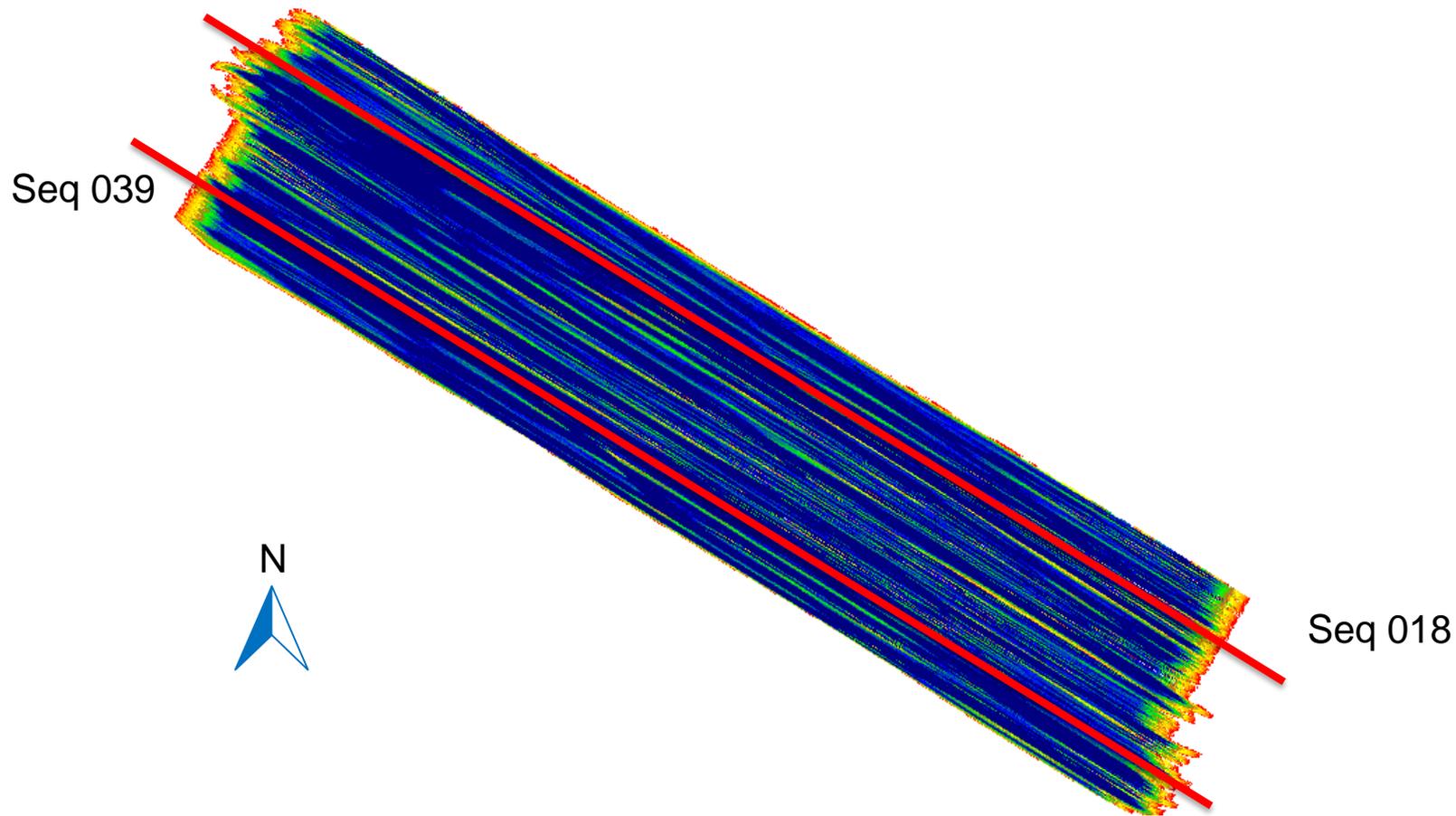
- **Display:**

Sailline 018, 039

Display: Stack, common channel and shot gathers.(Input; SRME Subtraction; SRME & MWD Subtraction; Difference from input; SRME & MWD Model)

- **Observation and Recommendation:**

Simultaneous subtraction with both MWD & SRME models shows benefit in multiple removal and primary protection. It's recommended to apply for production.



Seq 039

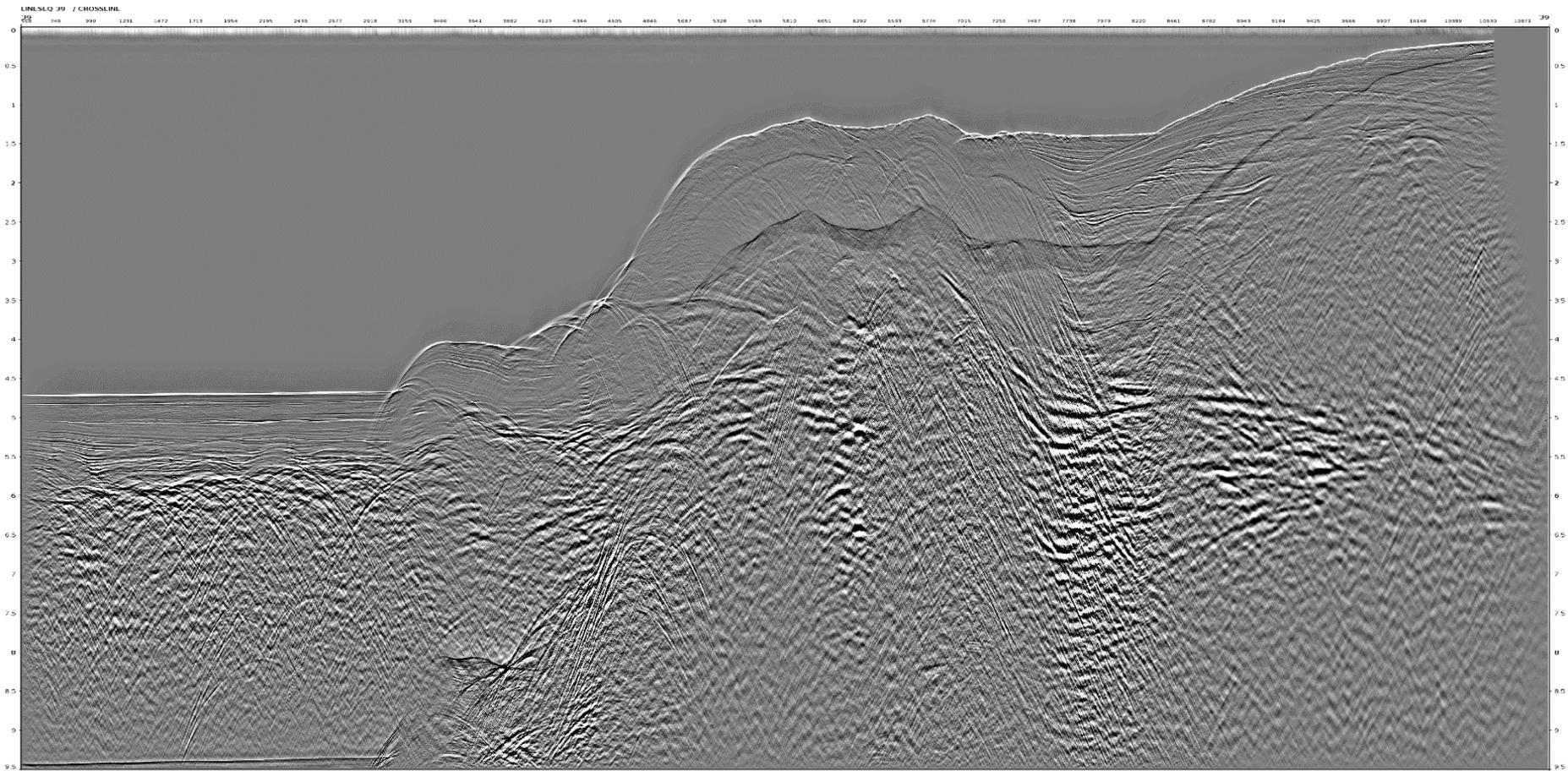
Stack

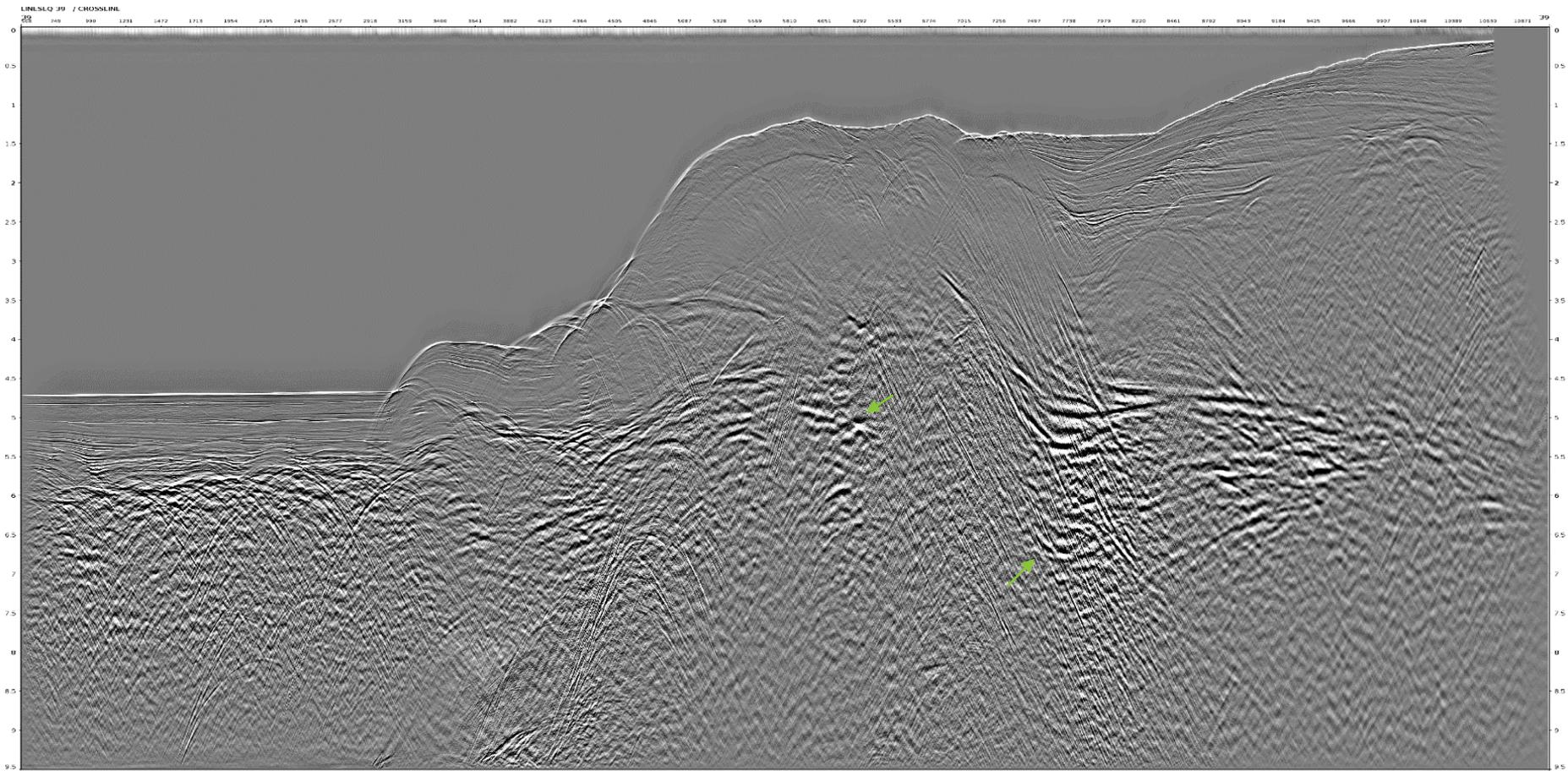
Common Channel

Shot Gathers

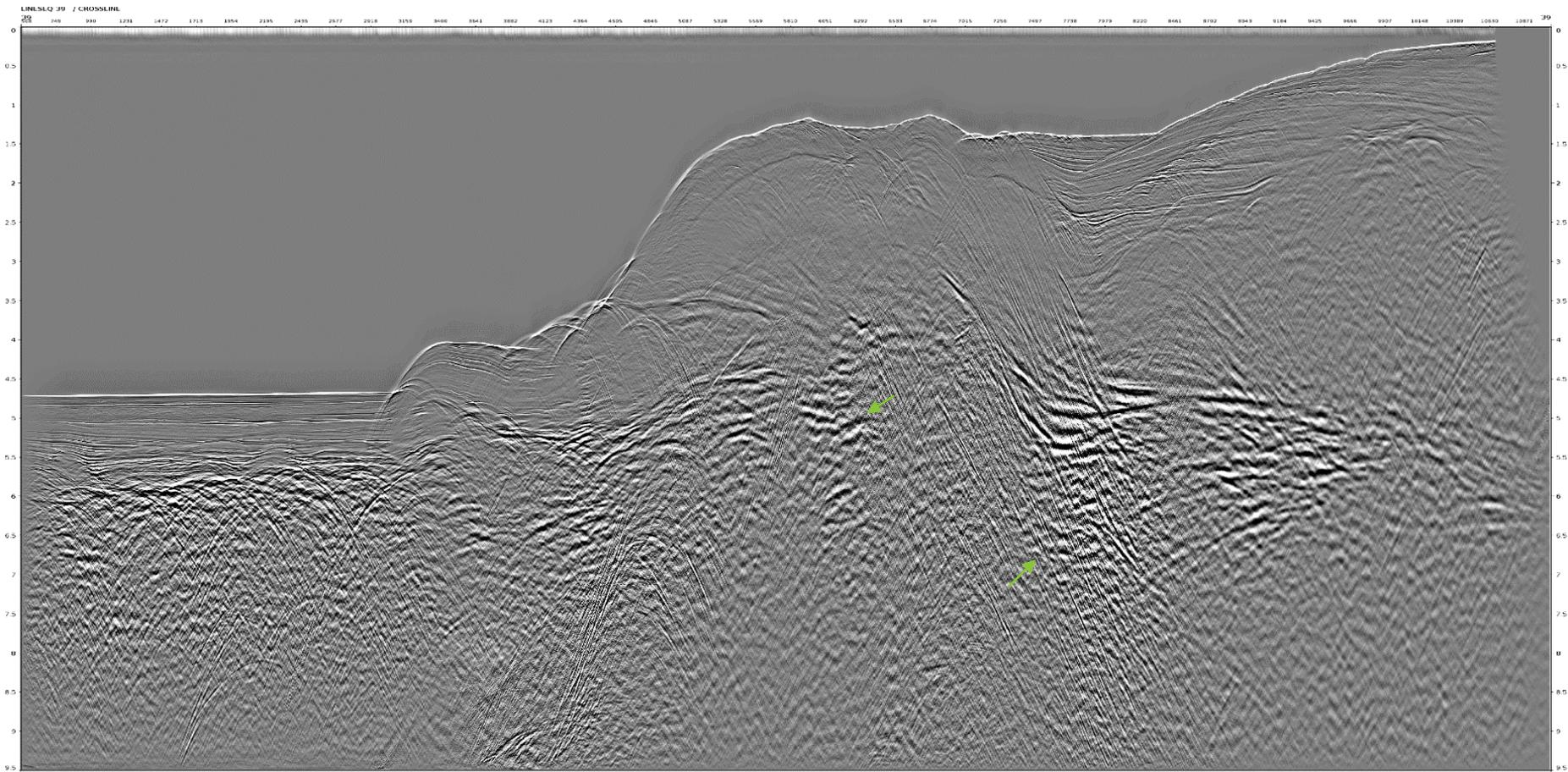


Stack before Subtraction

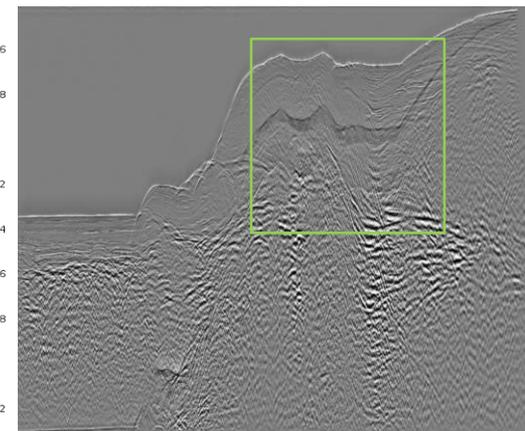
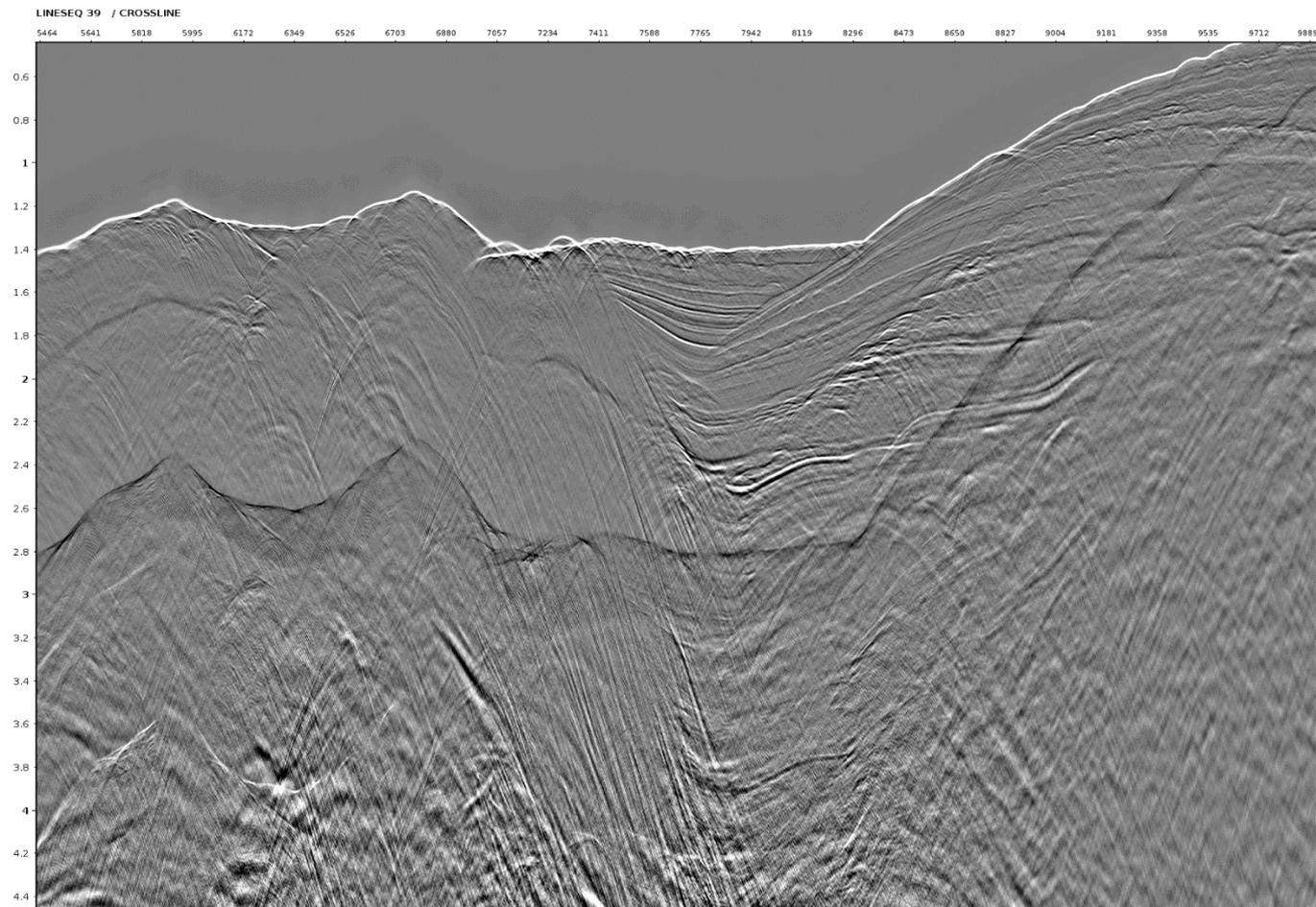




Stack after SRME & MWD Subtraction

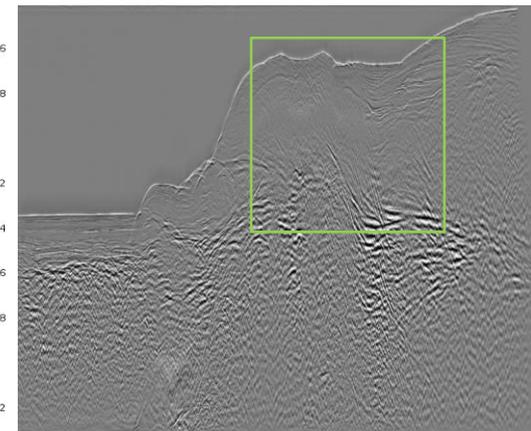
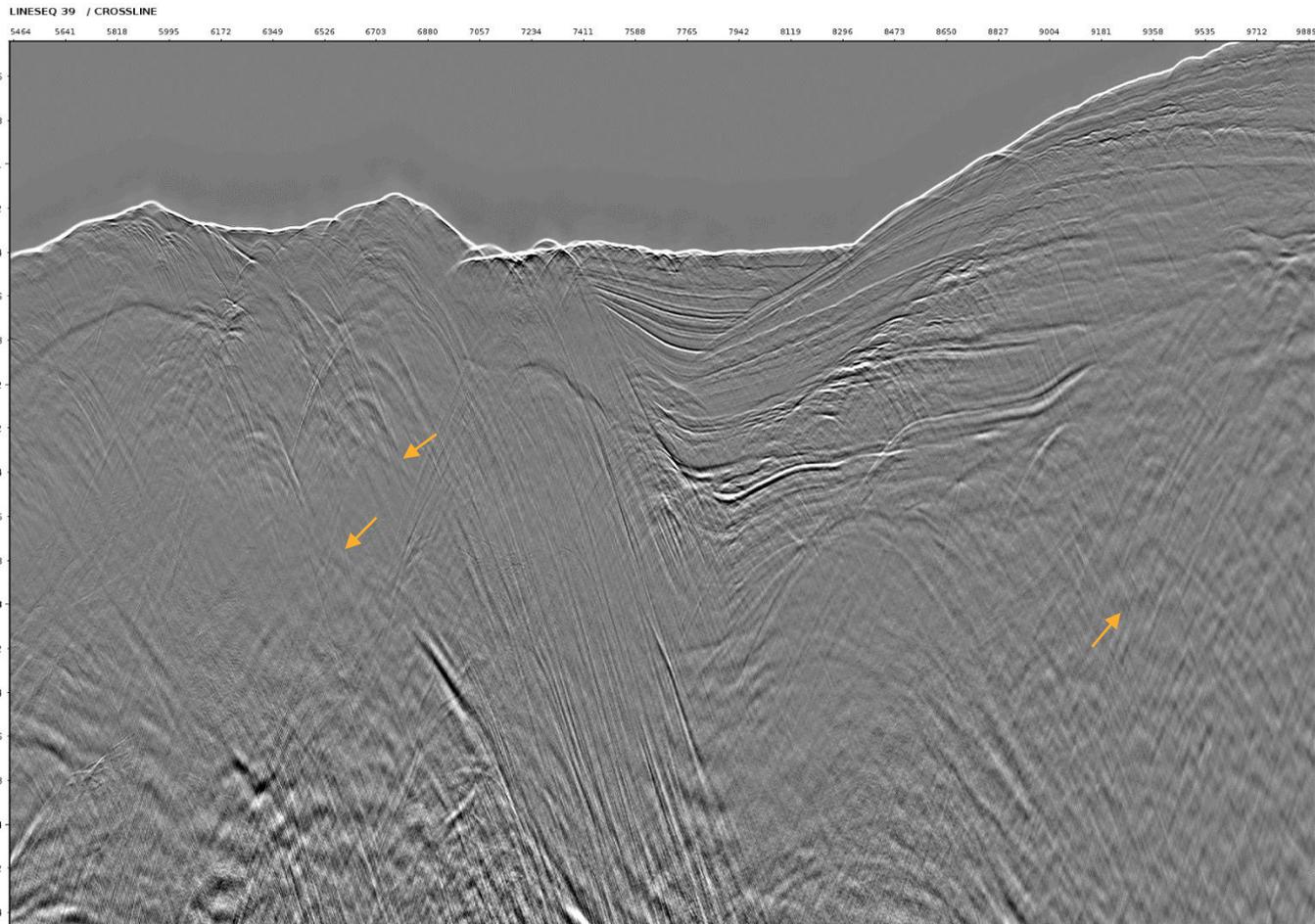


Zoom in Stack before Subtraction



- Primaries are protected by simultaneous subtraction flow.

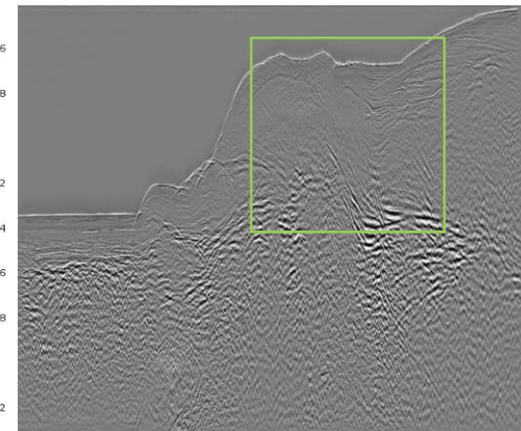
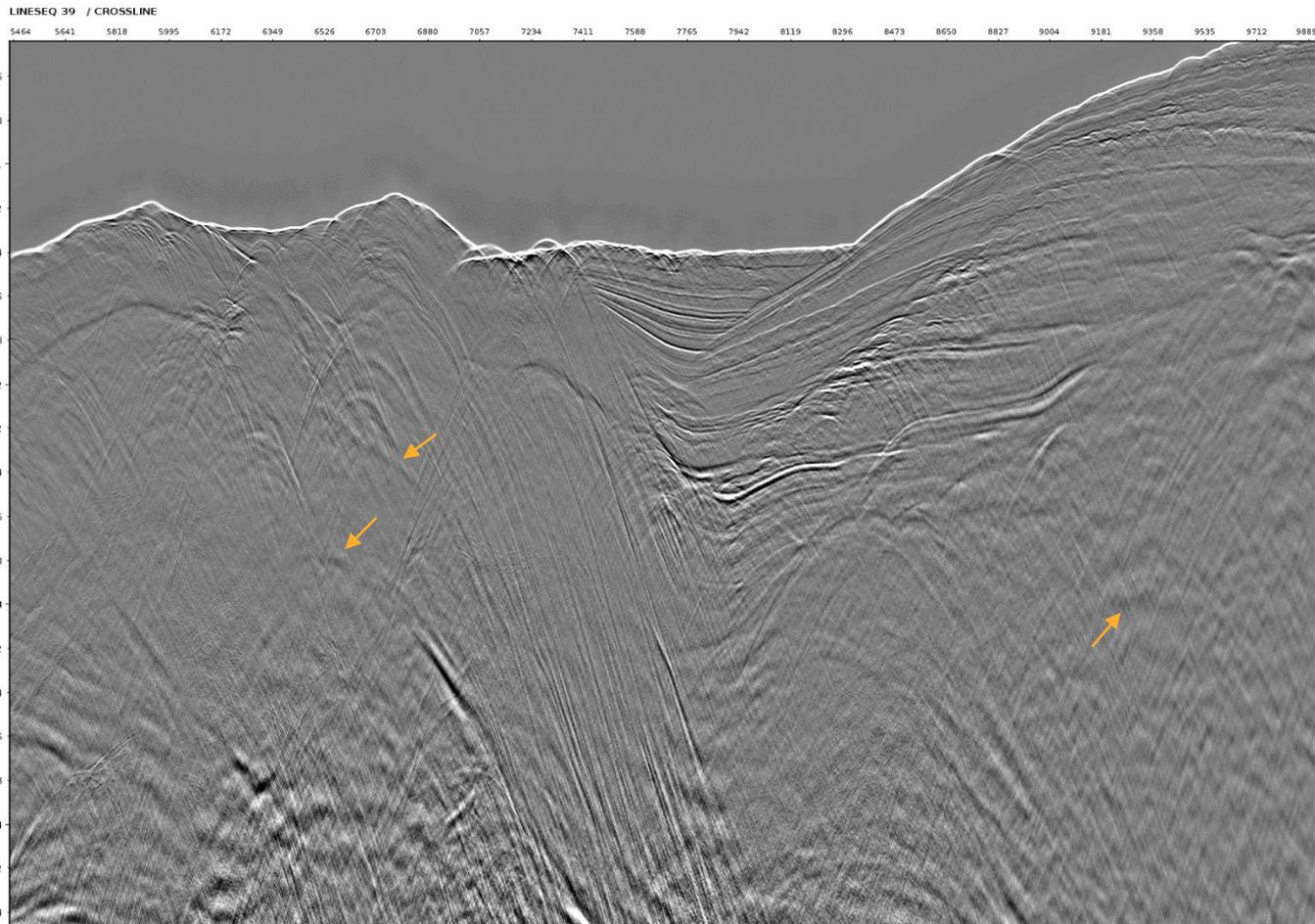
Zoom in Stack after SRME Subtraction



- Primaries are protected by simultaneous subtraction flow.



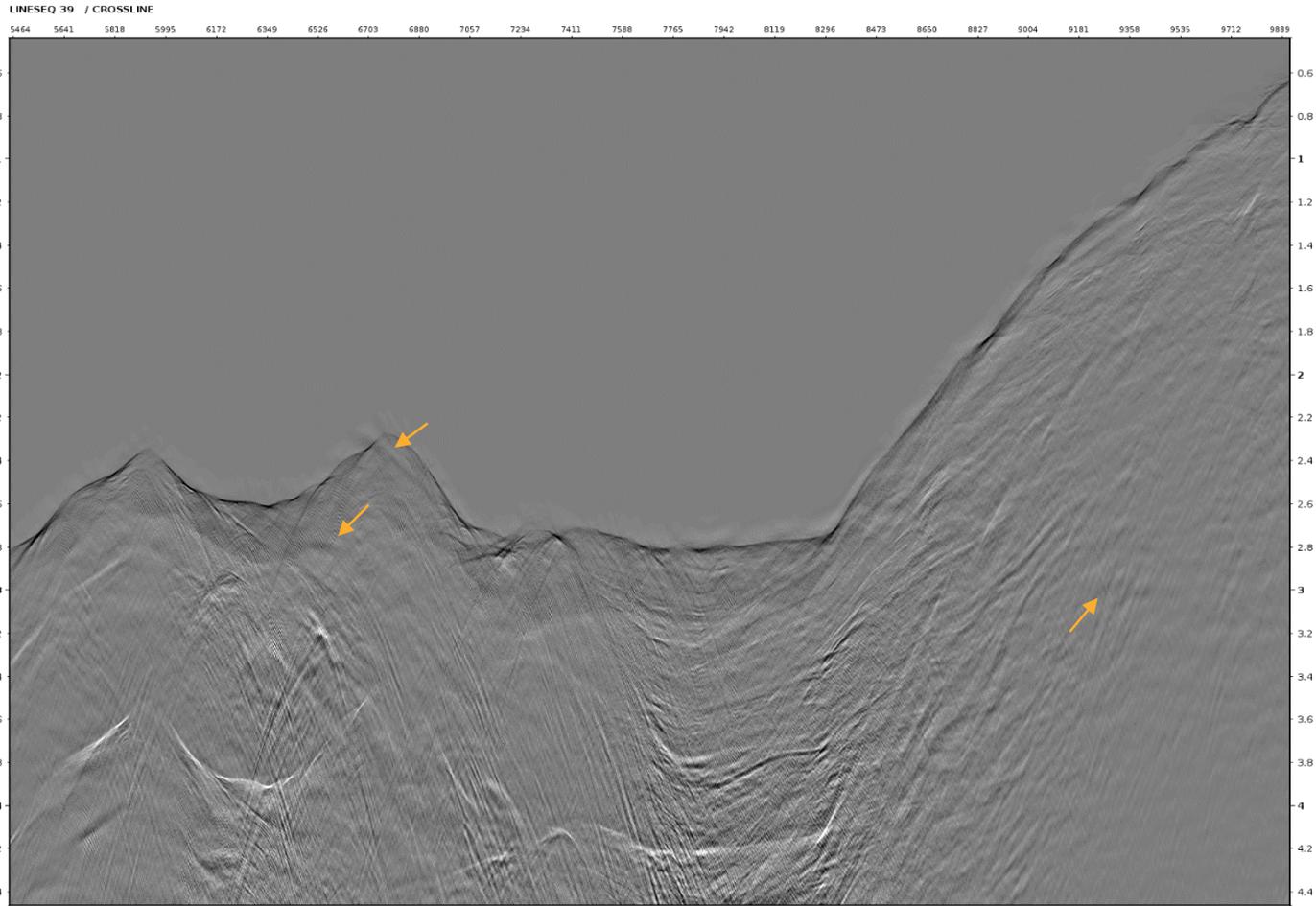
Zoom in Stack after SRME & MWD Subtraction



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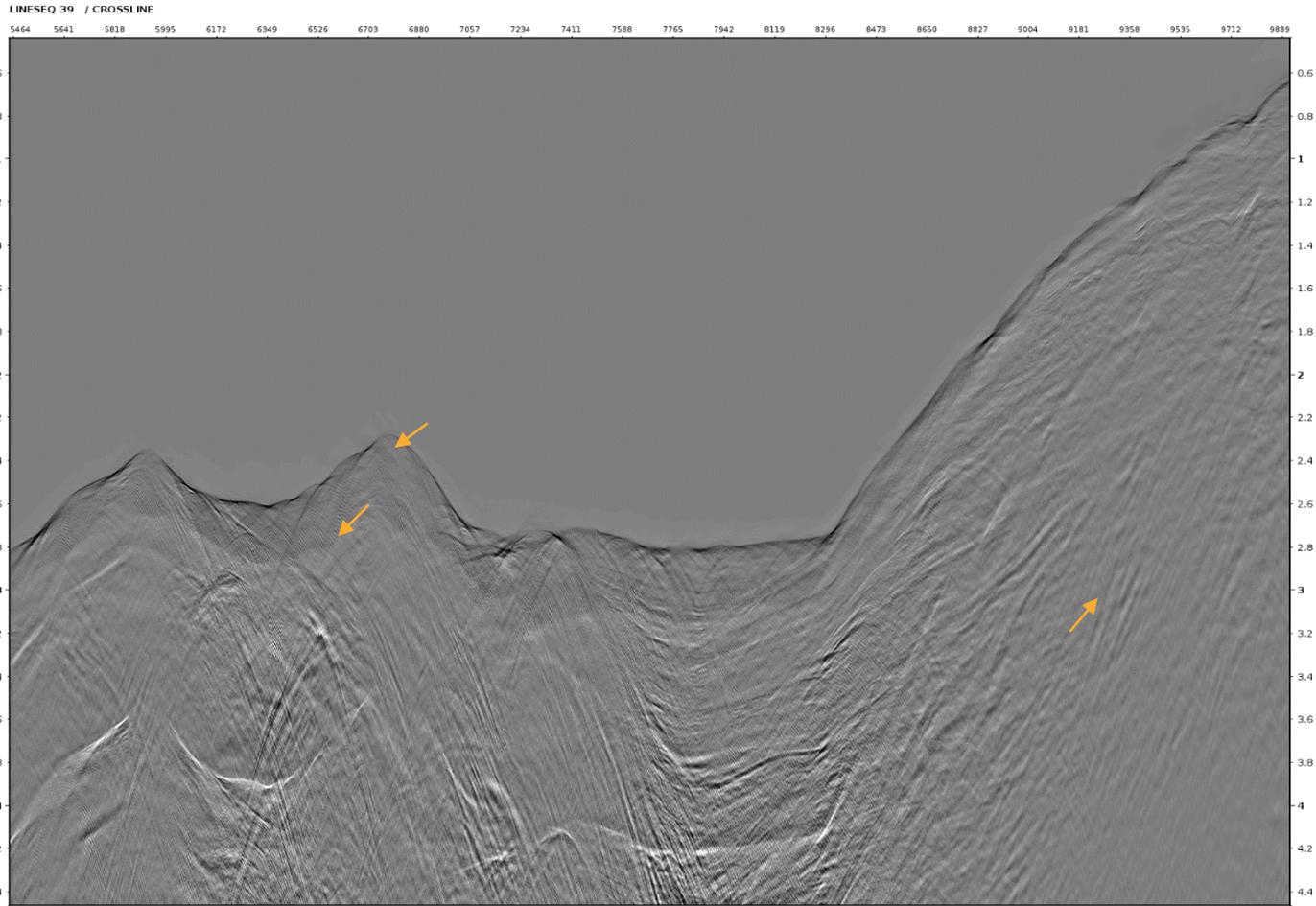


Difference before – after SRME Subtraction

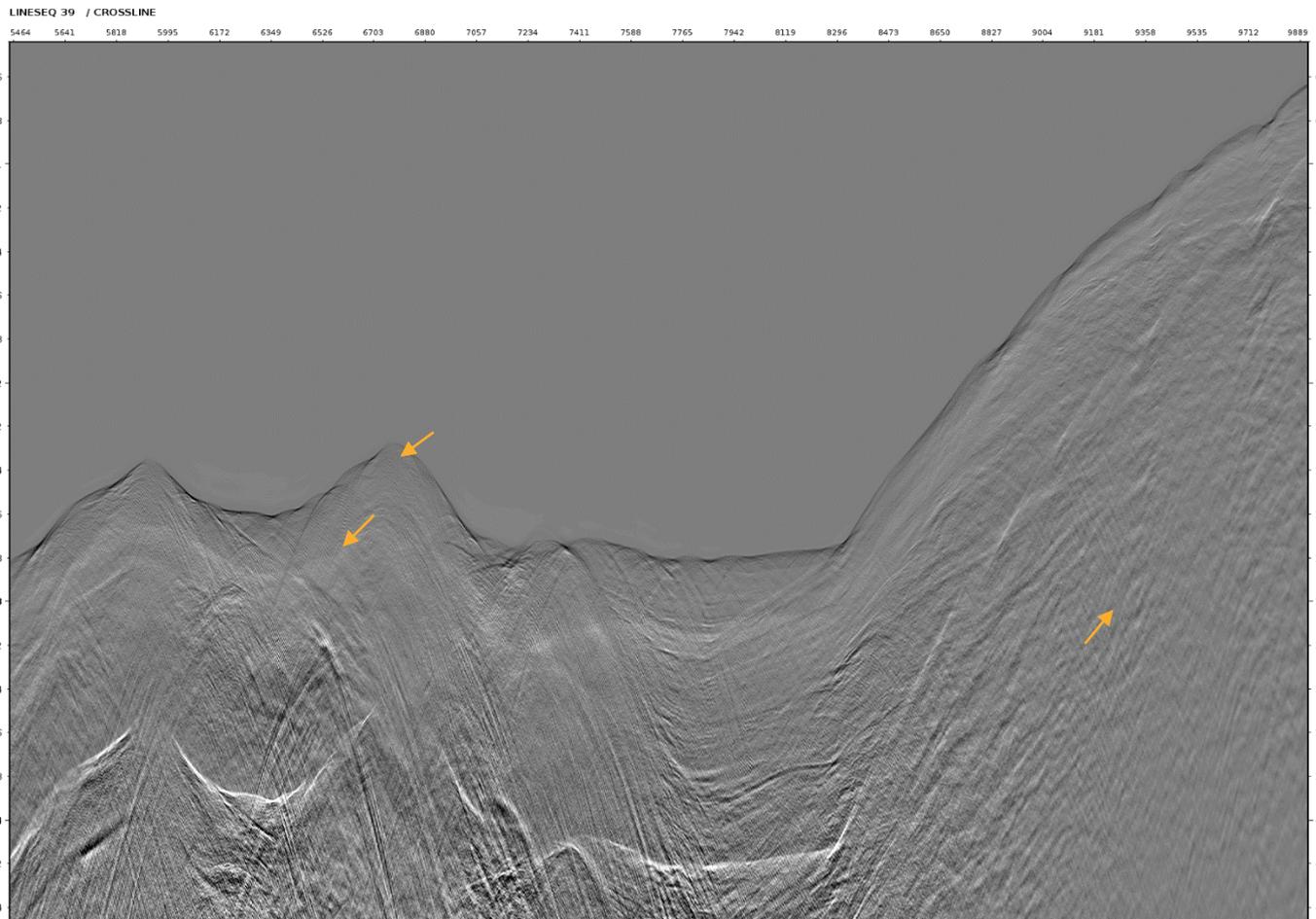




Difference before – after SRME & MWD Subtraction

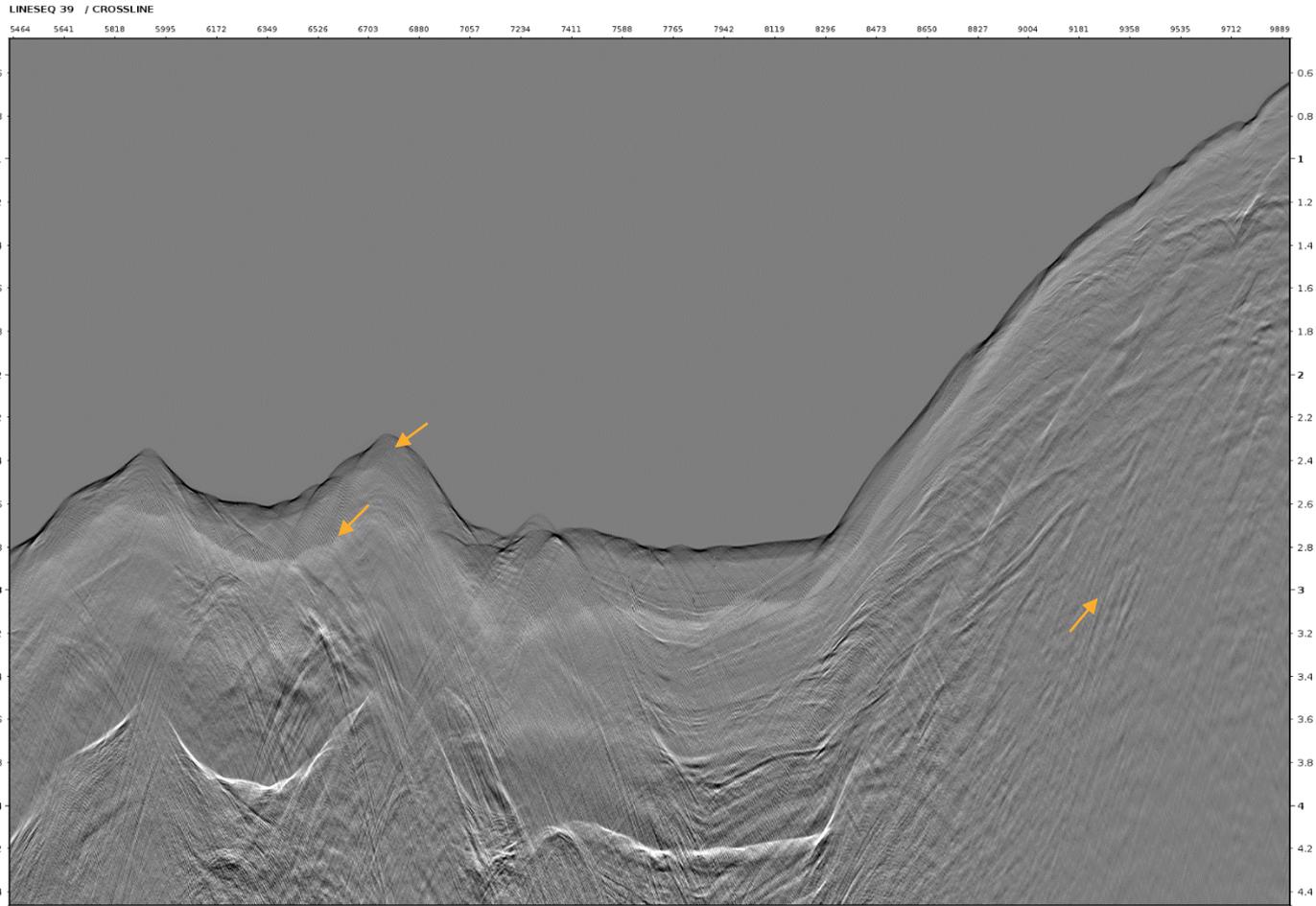


Zoom in Stack – SRME Model



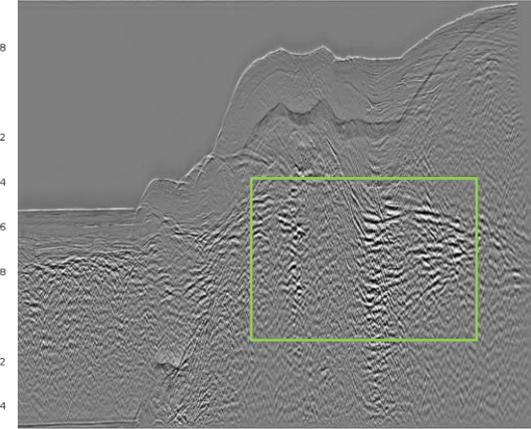
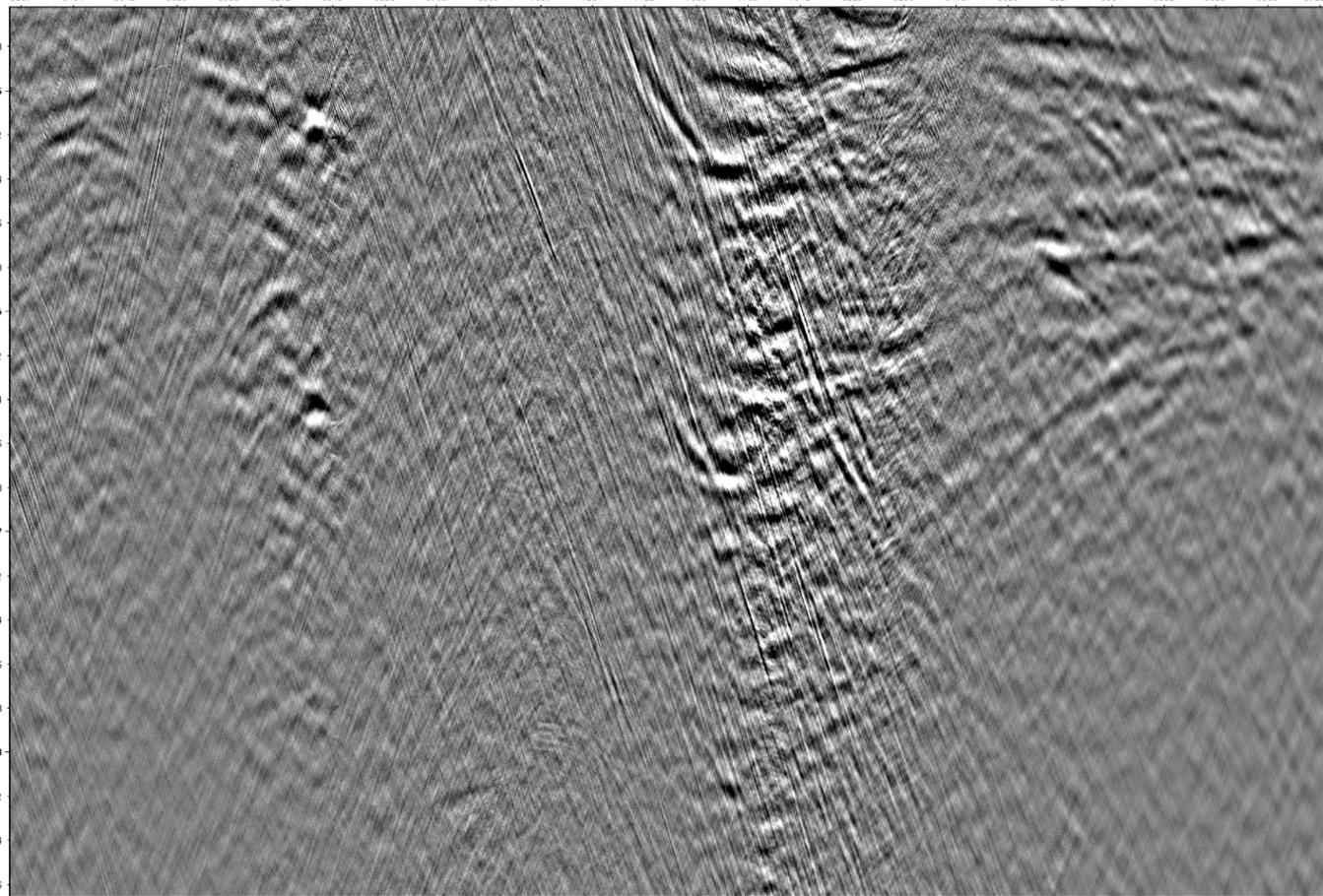


Zoom in Stack – MWD Model



Zoom in Stack before Subtraction

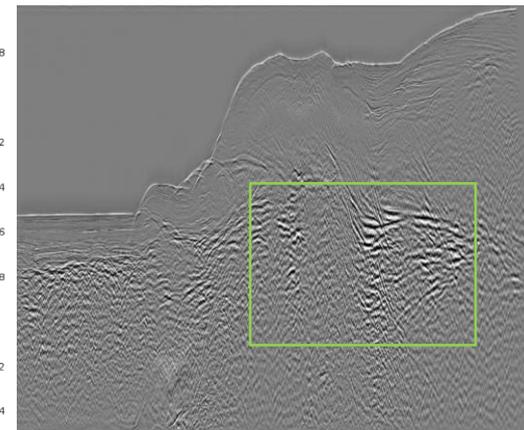
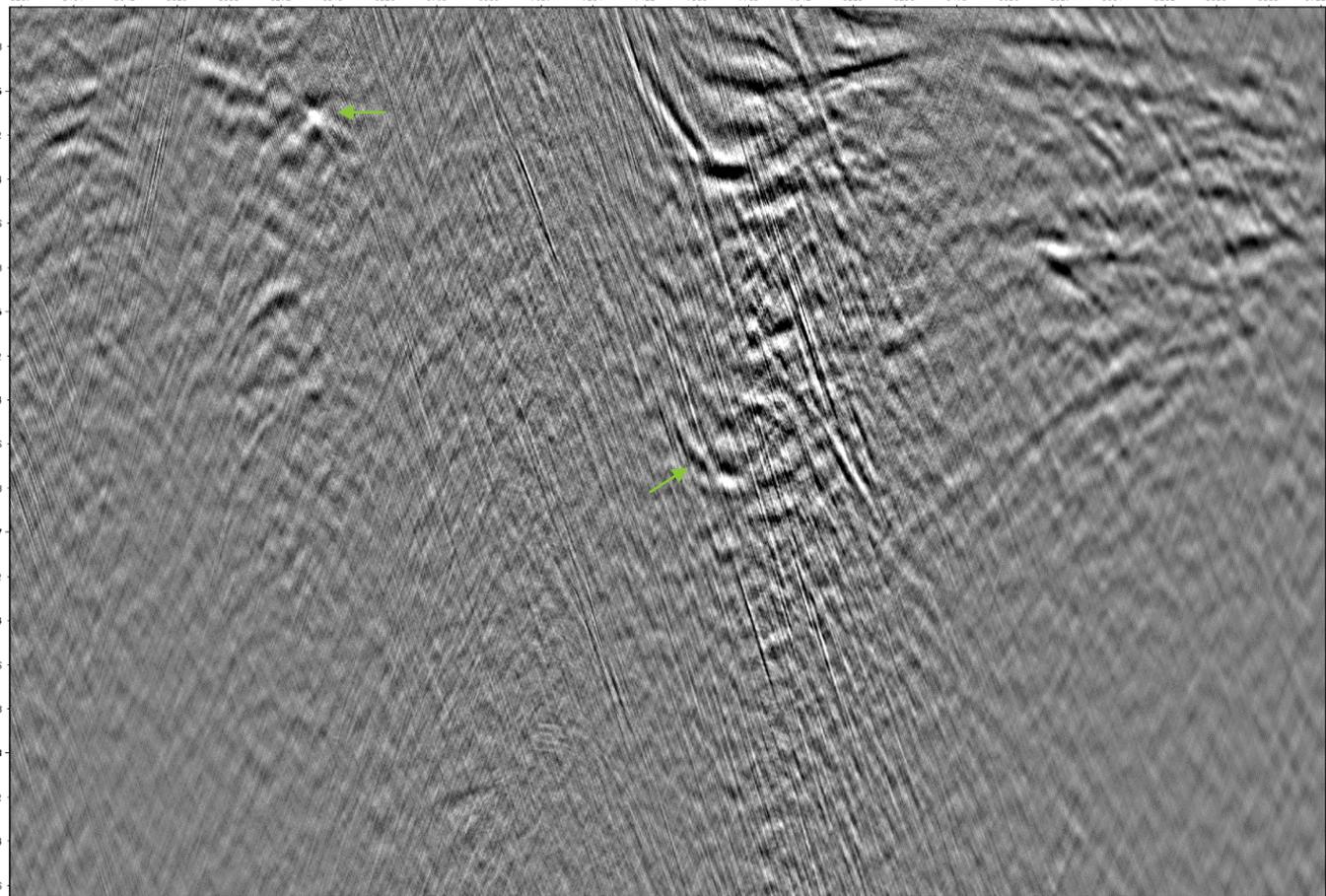
LINESEQ 39 / CROSSLINE
5287 5464 5641 5818 5995 6172 6349 6526 6703 6880 7057 7234 7411 7588 7765 7942 8119 8296 8473 8650 8827 9004 9181 9358 9535 9712



- Multiples are better attenuated with simultaneous subtraction.

Zoom in Stack after SRME Subtraction

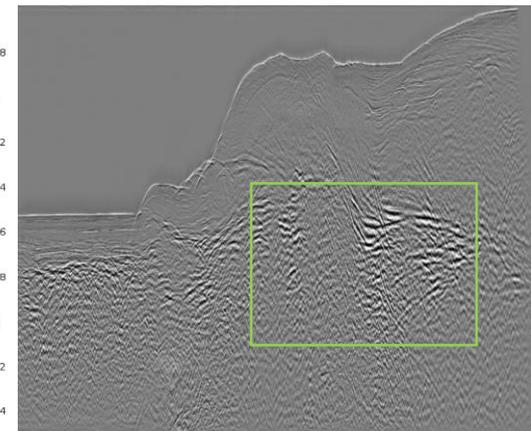
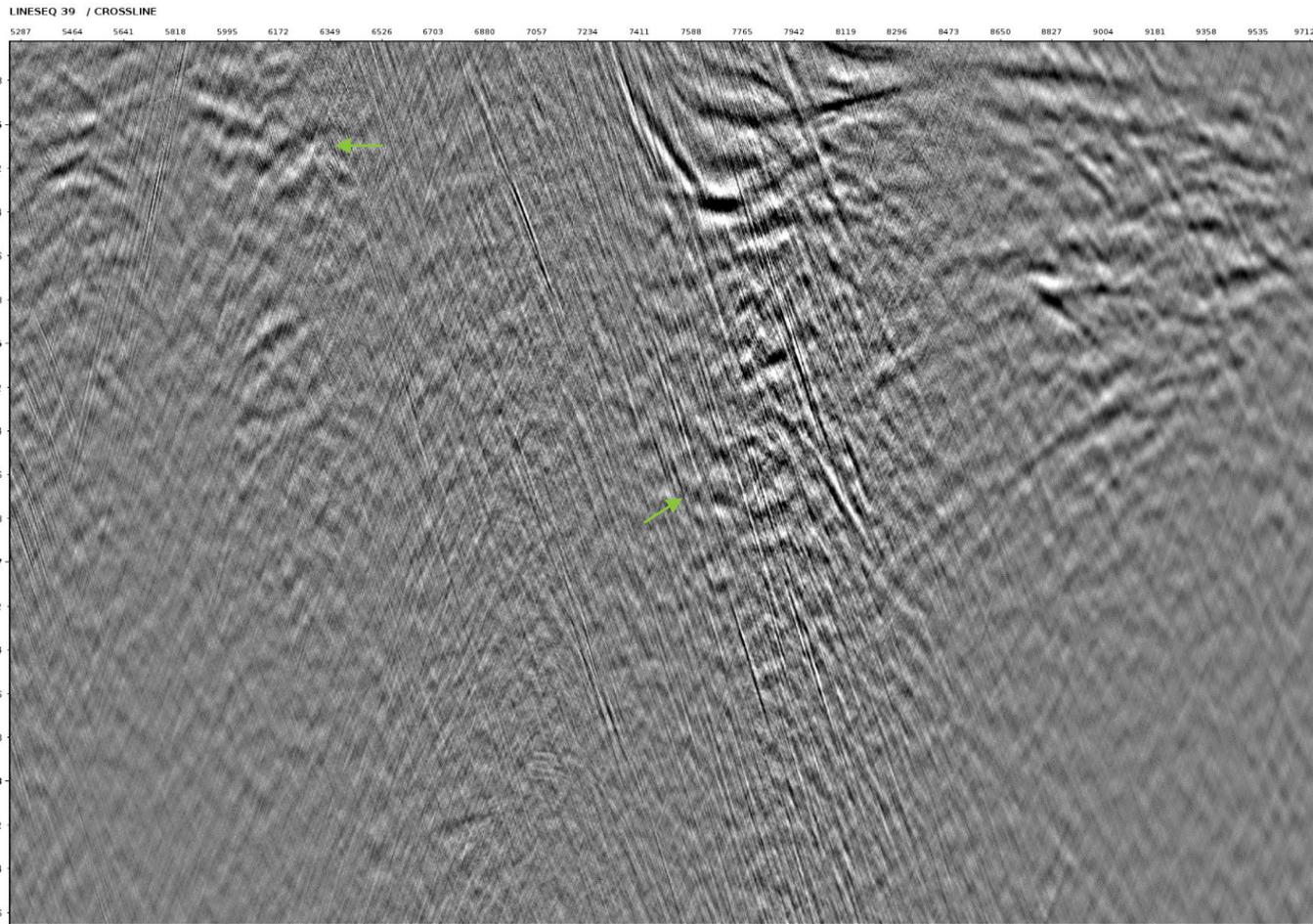
LINESEQ 39 / CROSSLINE



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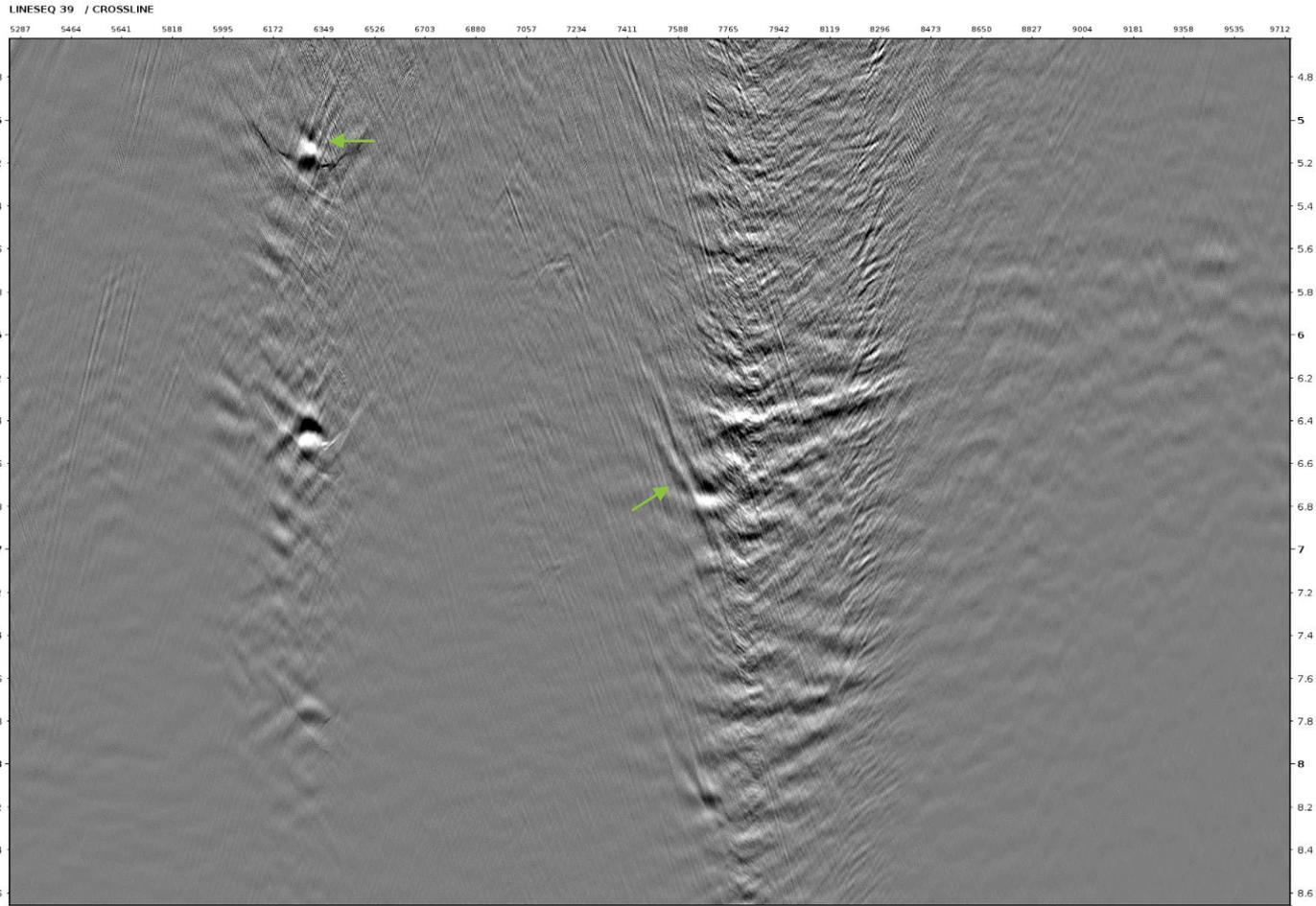
Zoom in Stack after SRME & MWD Subtraction



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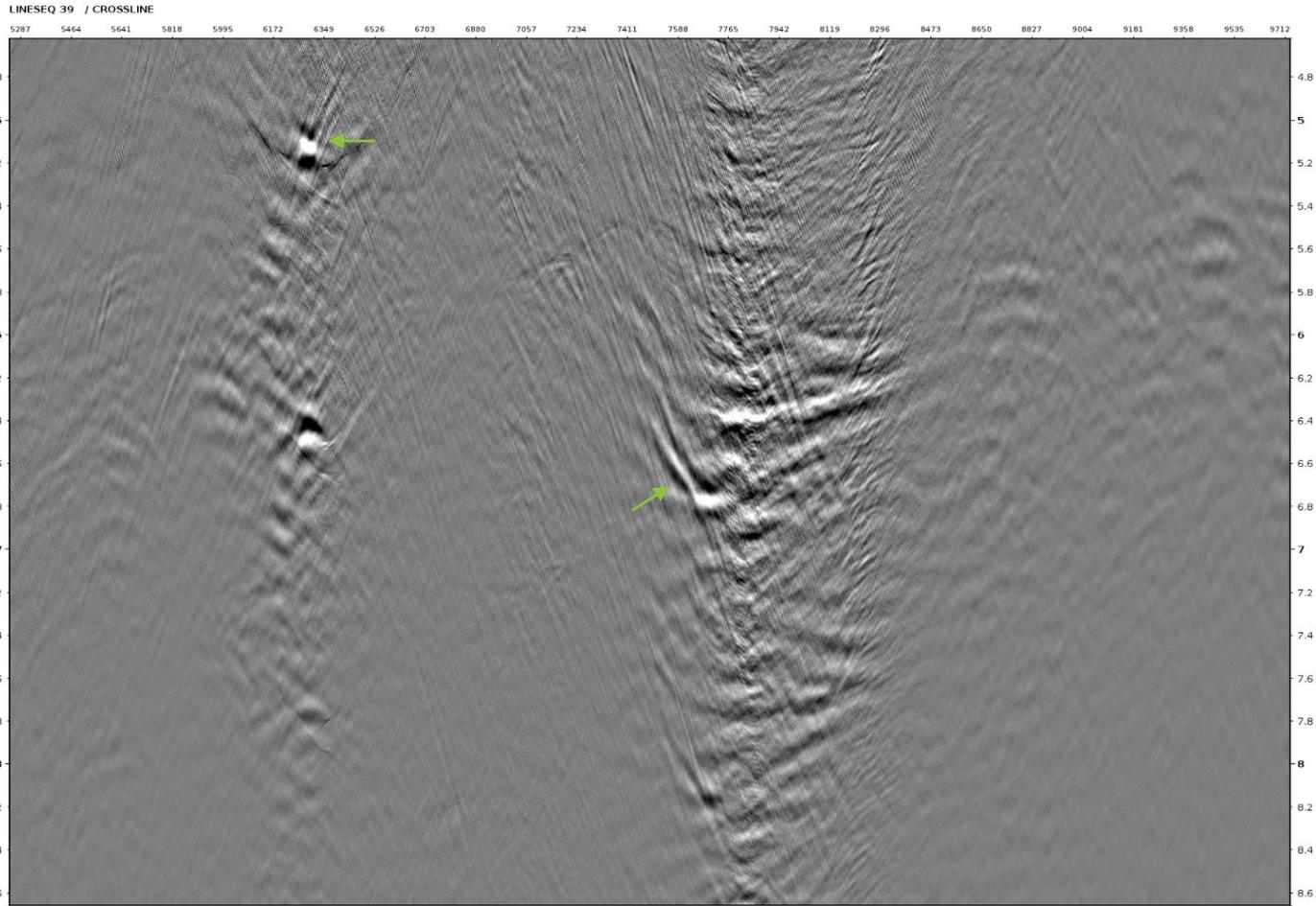


Difference before – after SRME Subtraction

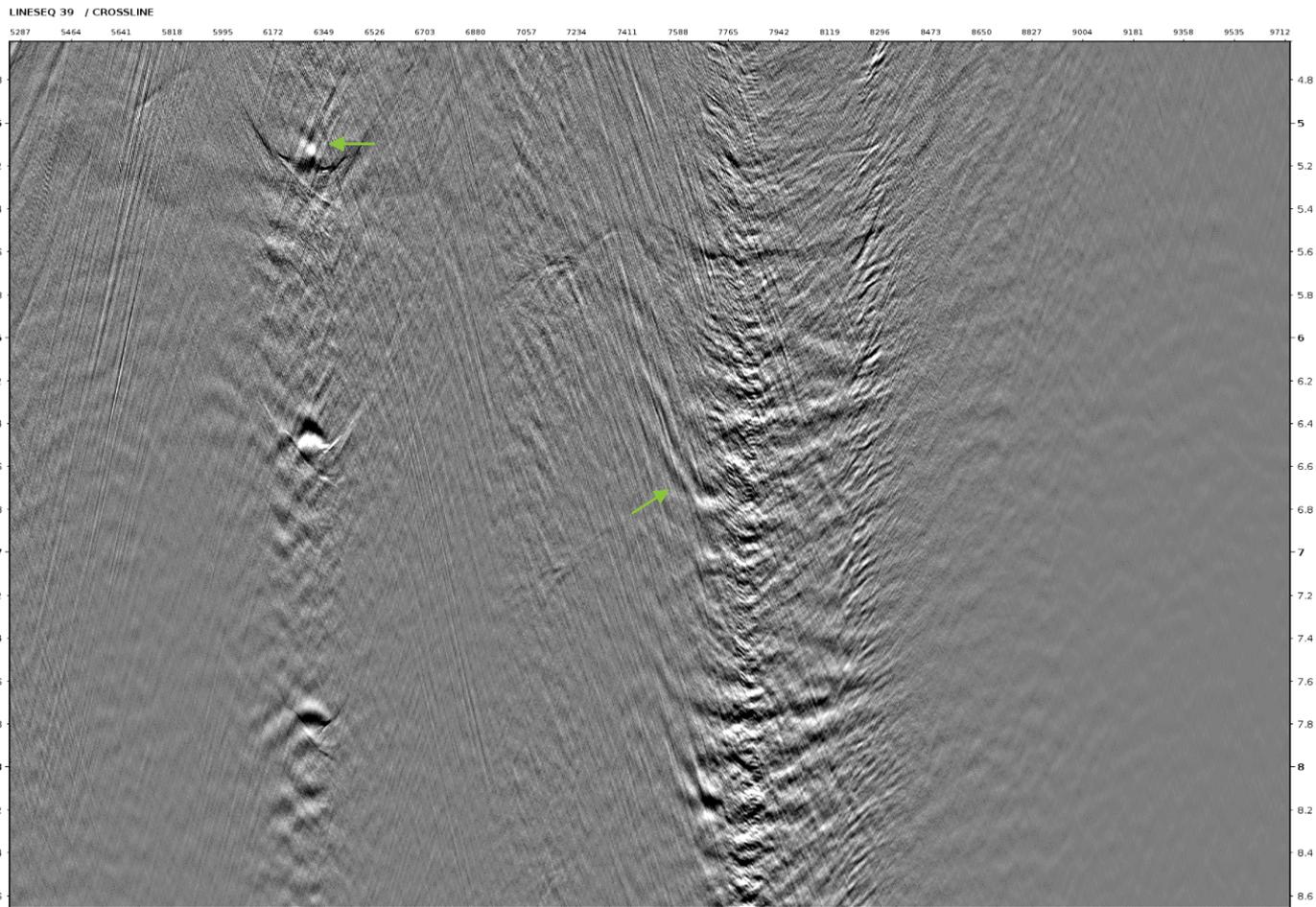




Difference before – after SRME & MWD Subtraction



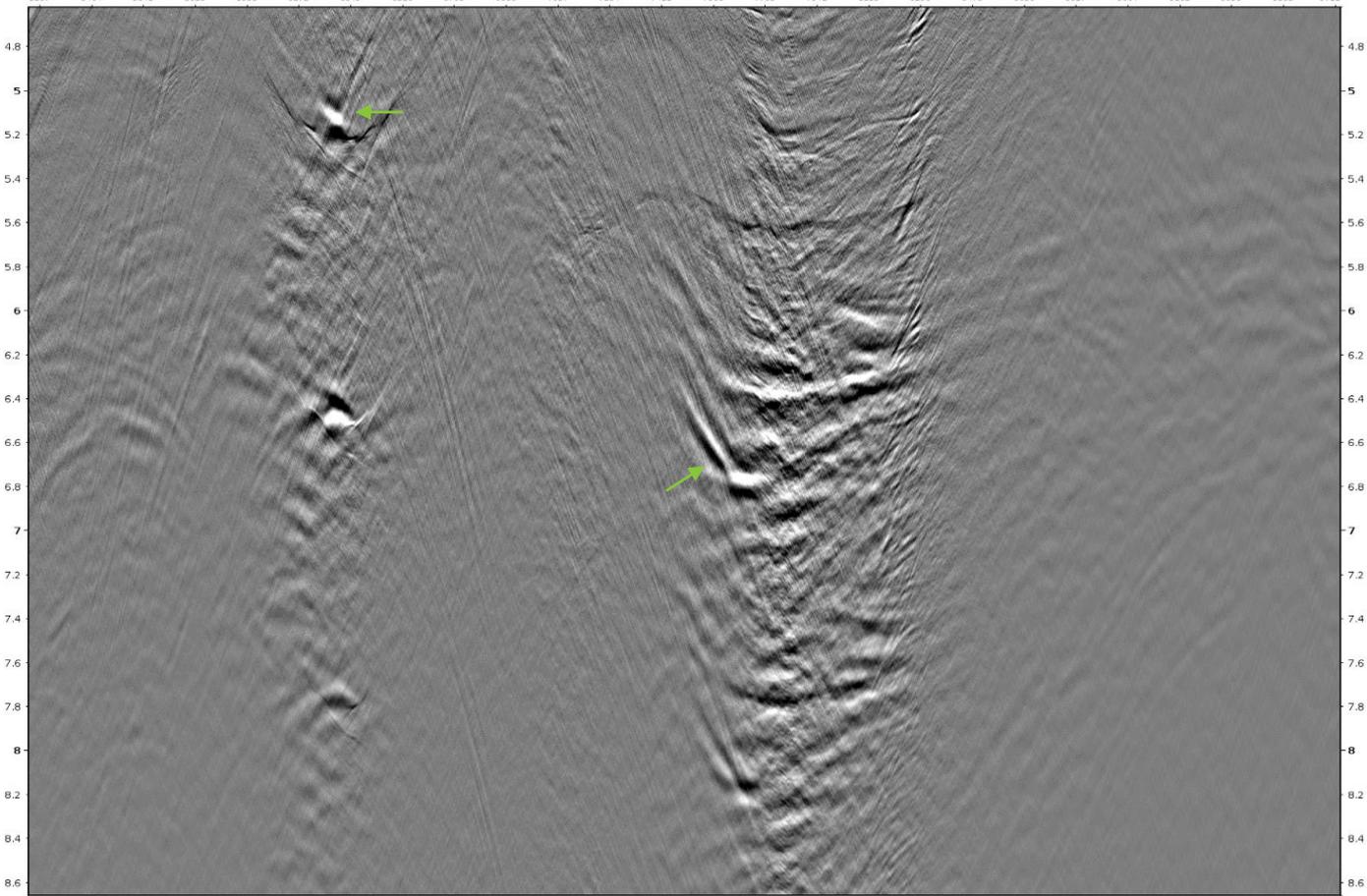
Zoom in Stack – SRME Model





Zoom in Stack – MWD Model

LINESEQ 39 / CROSSLINE
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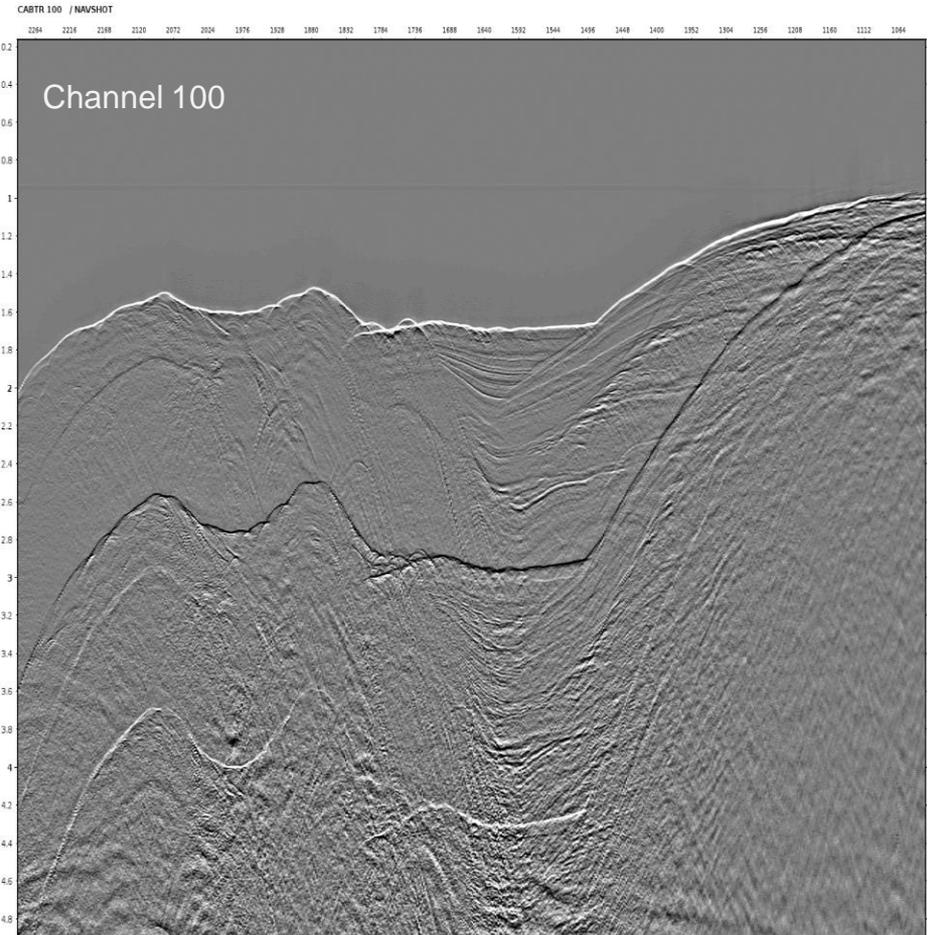
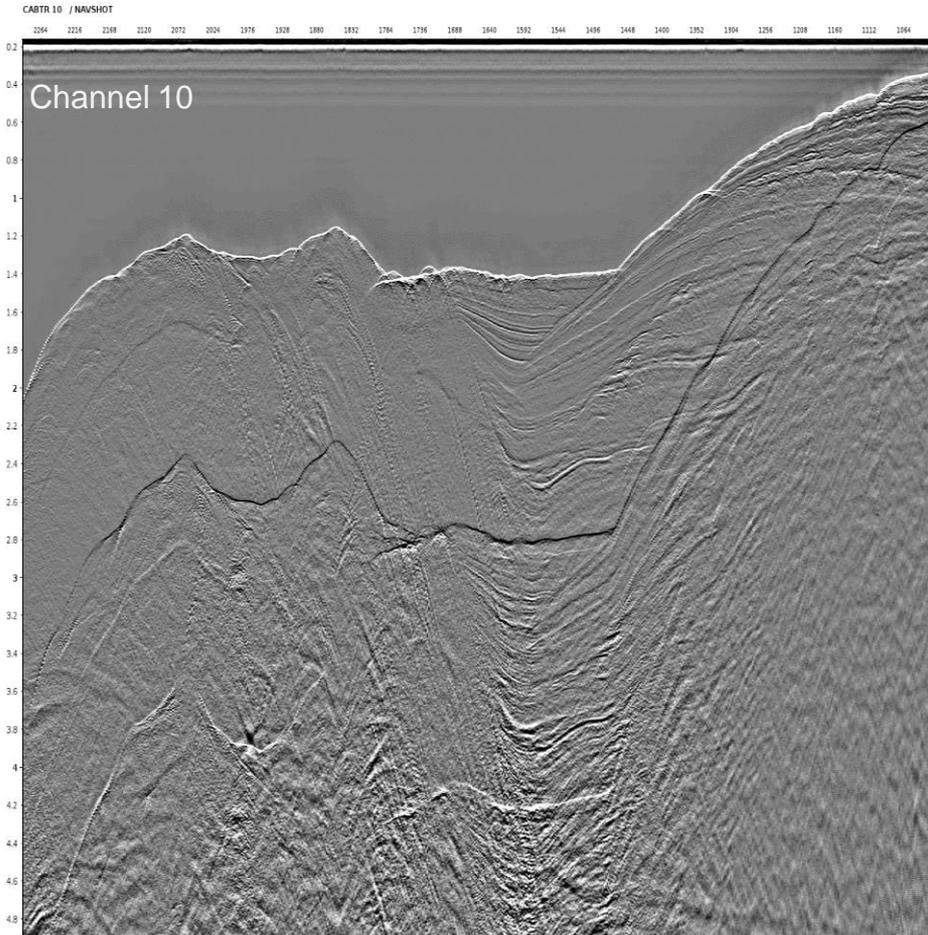
Seq 039

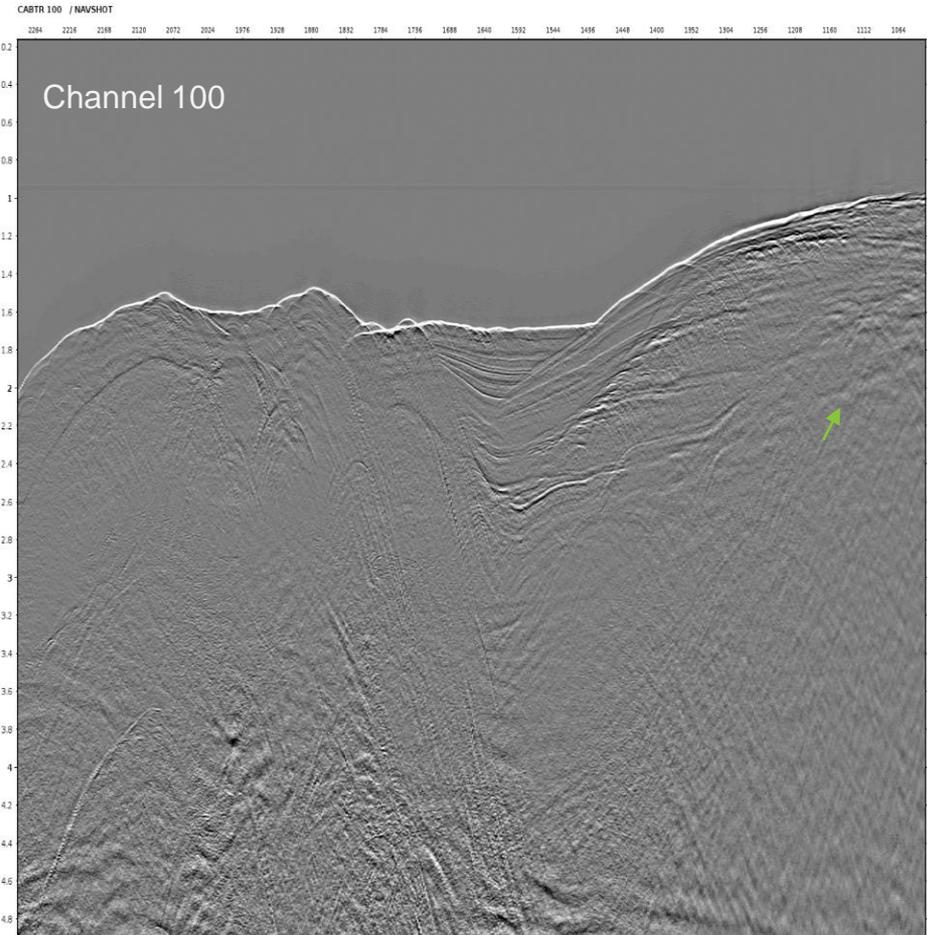
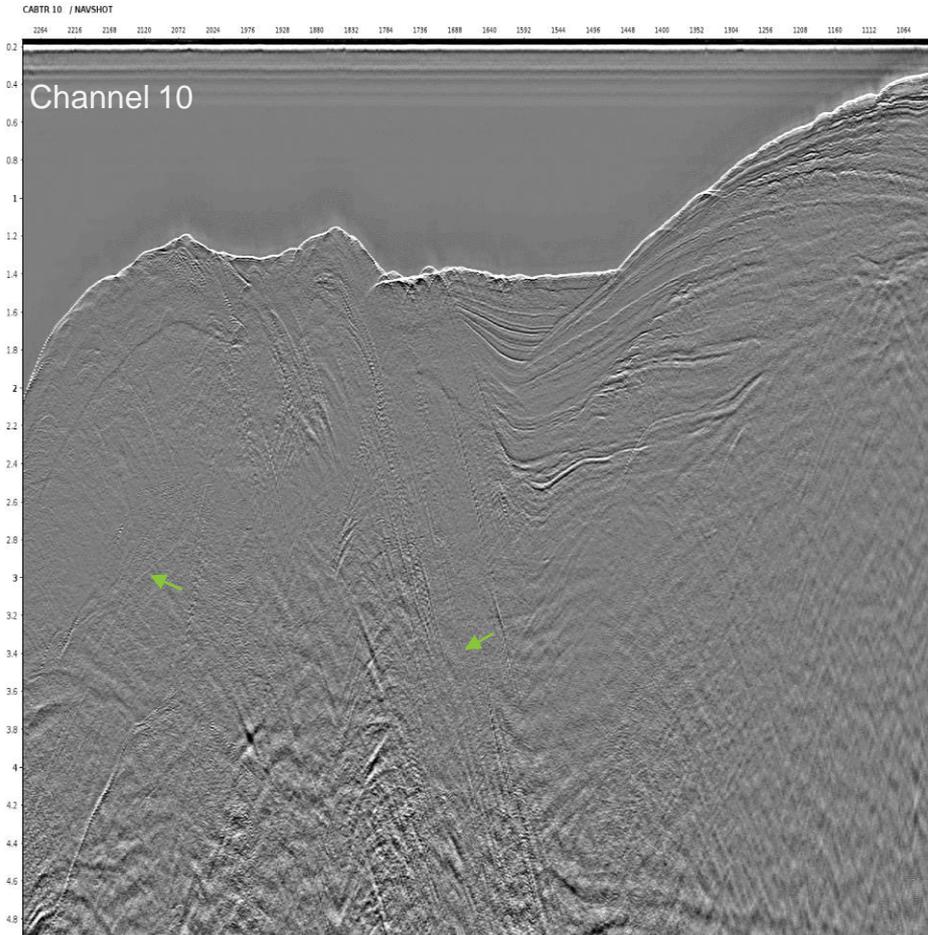
Stack

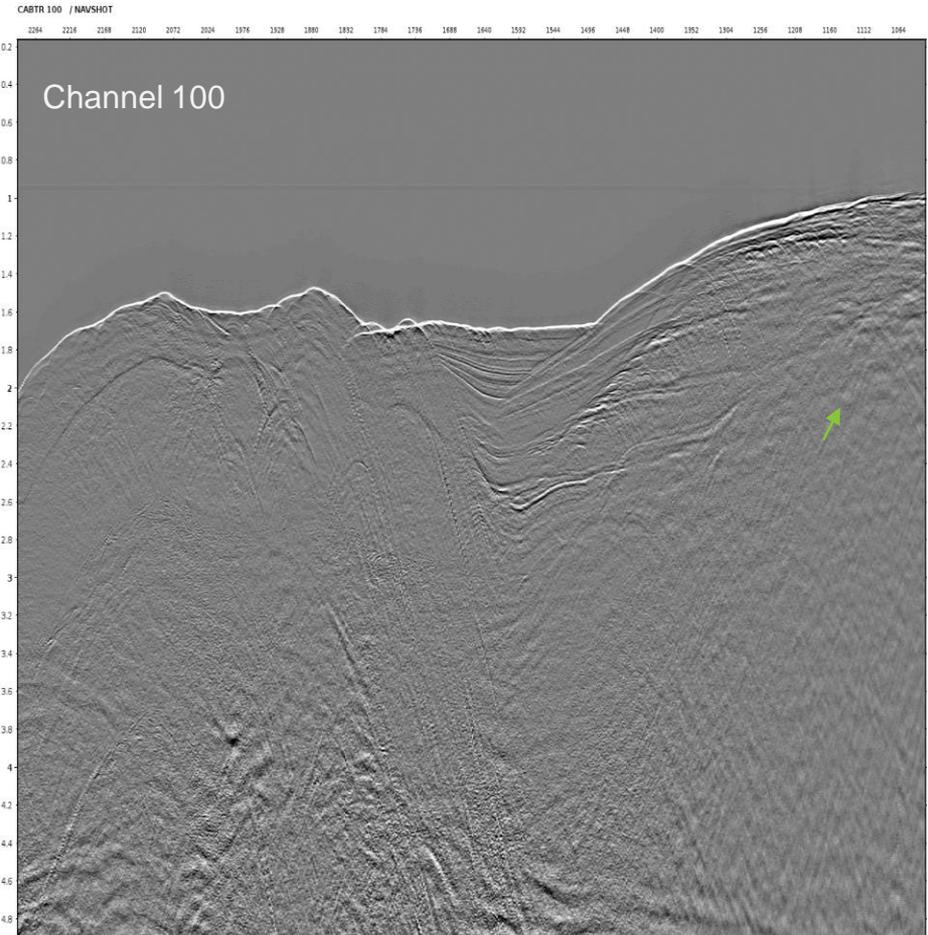
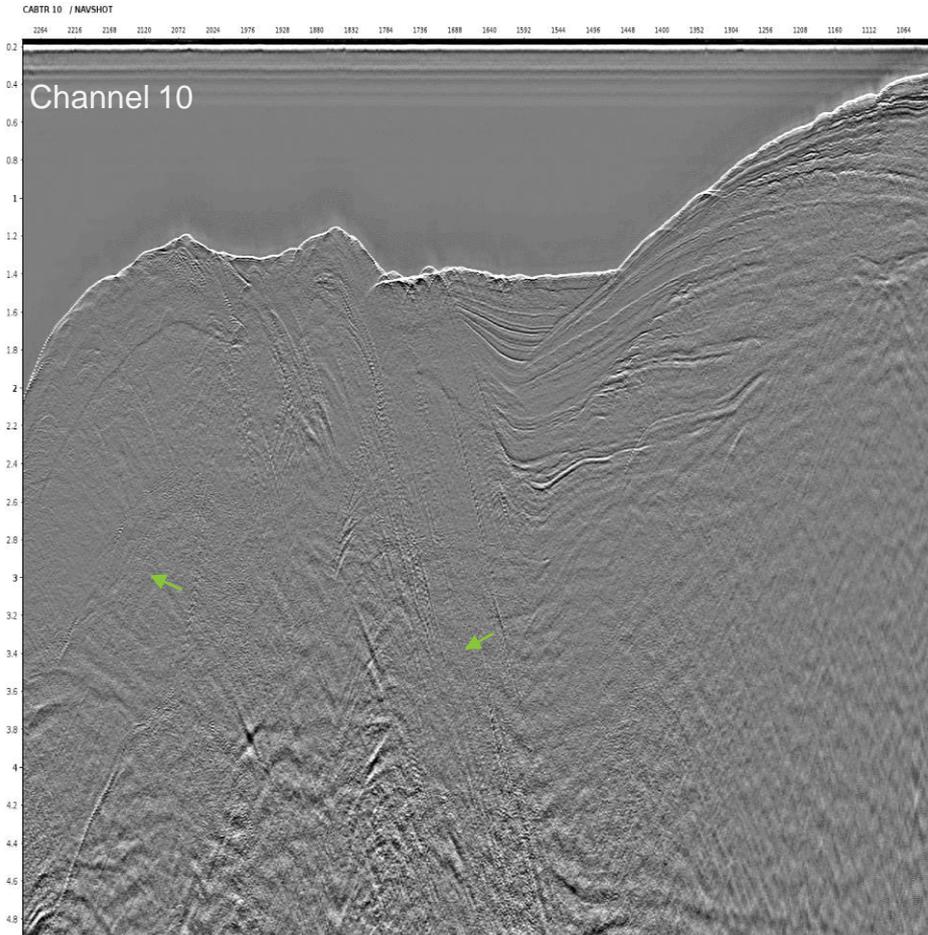
Common Channel

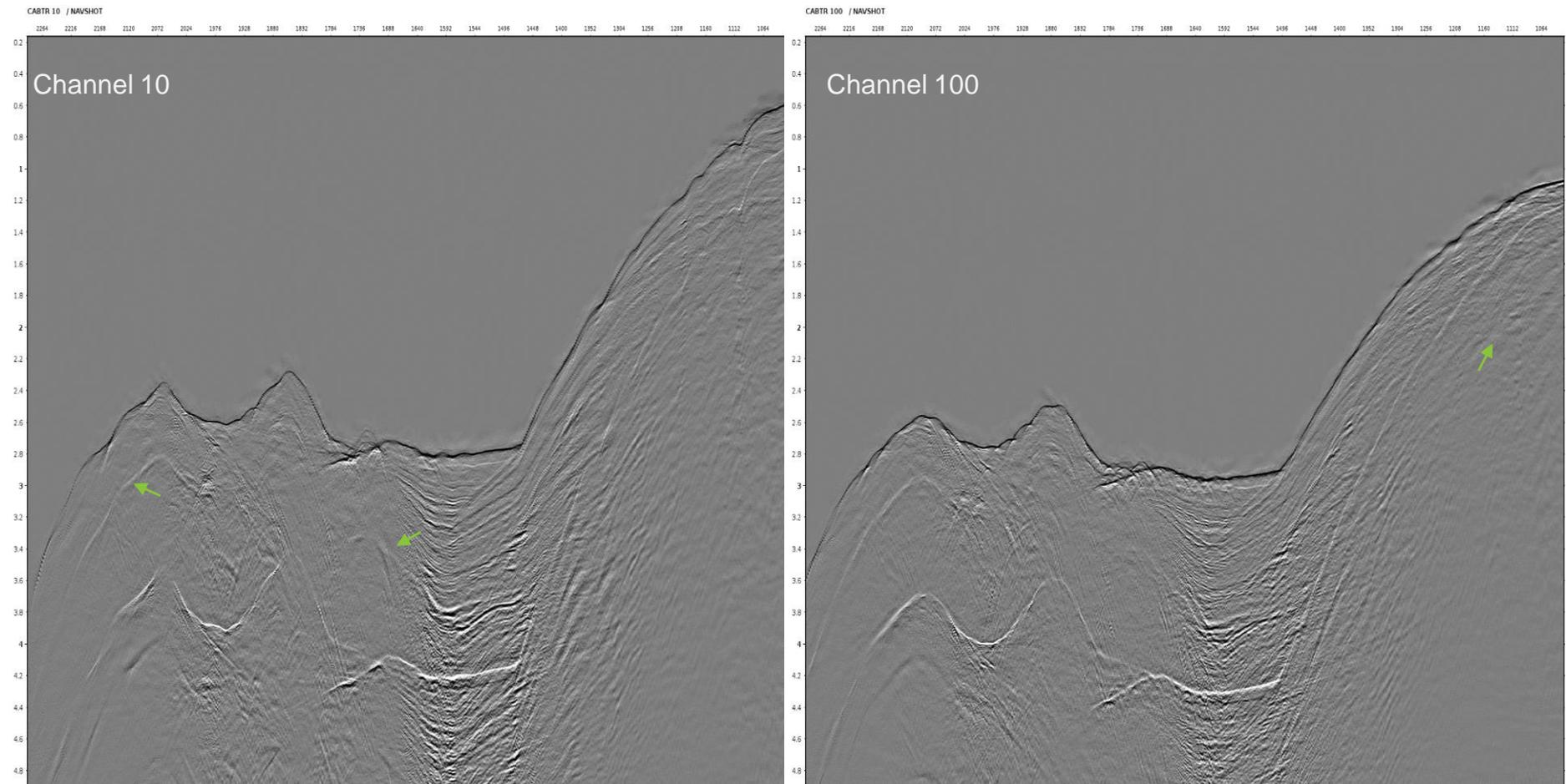
Shot Gathers





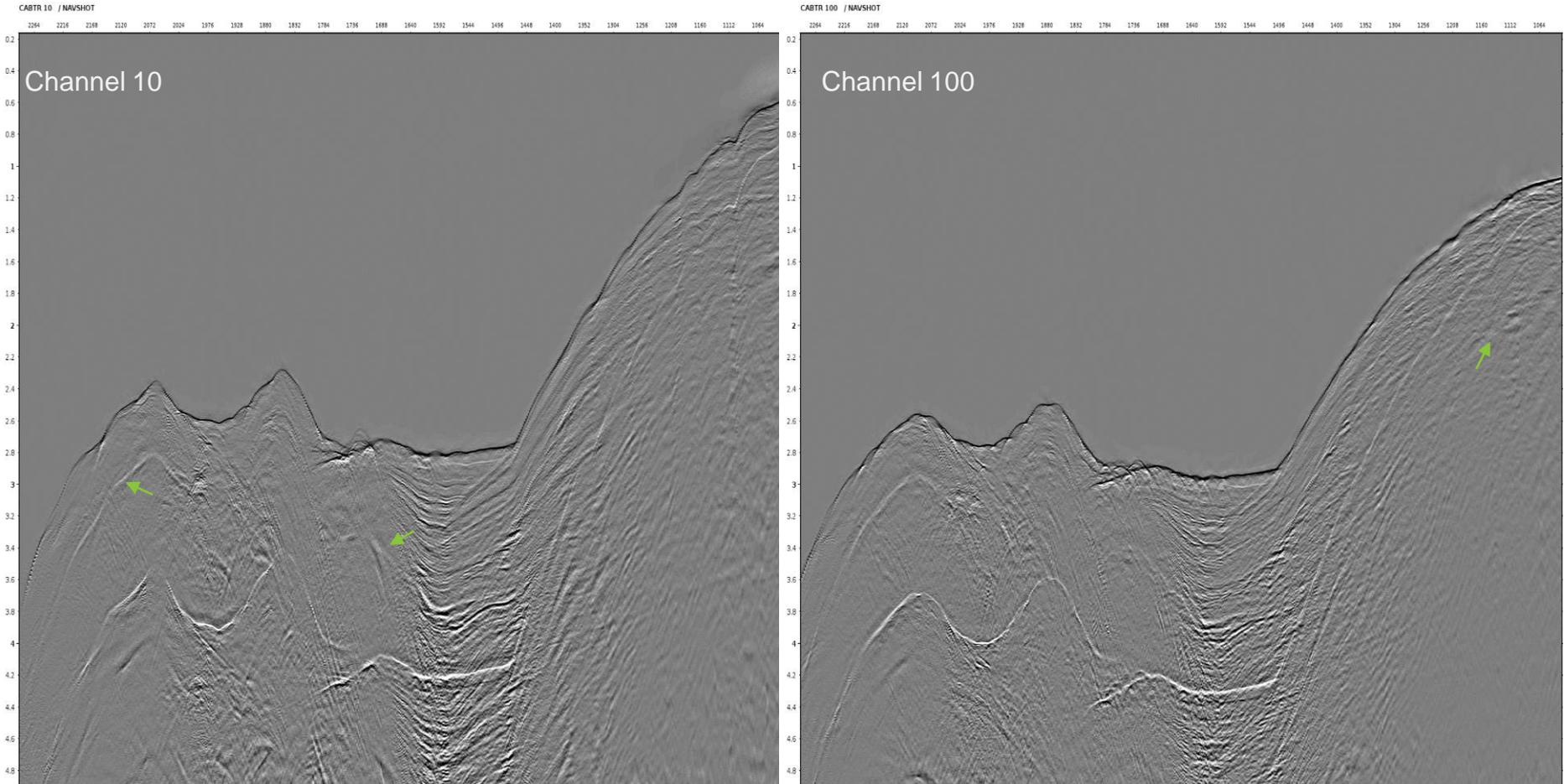






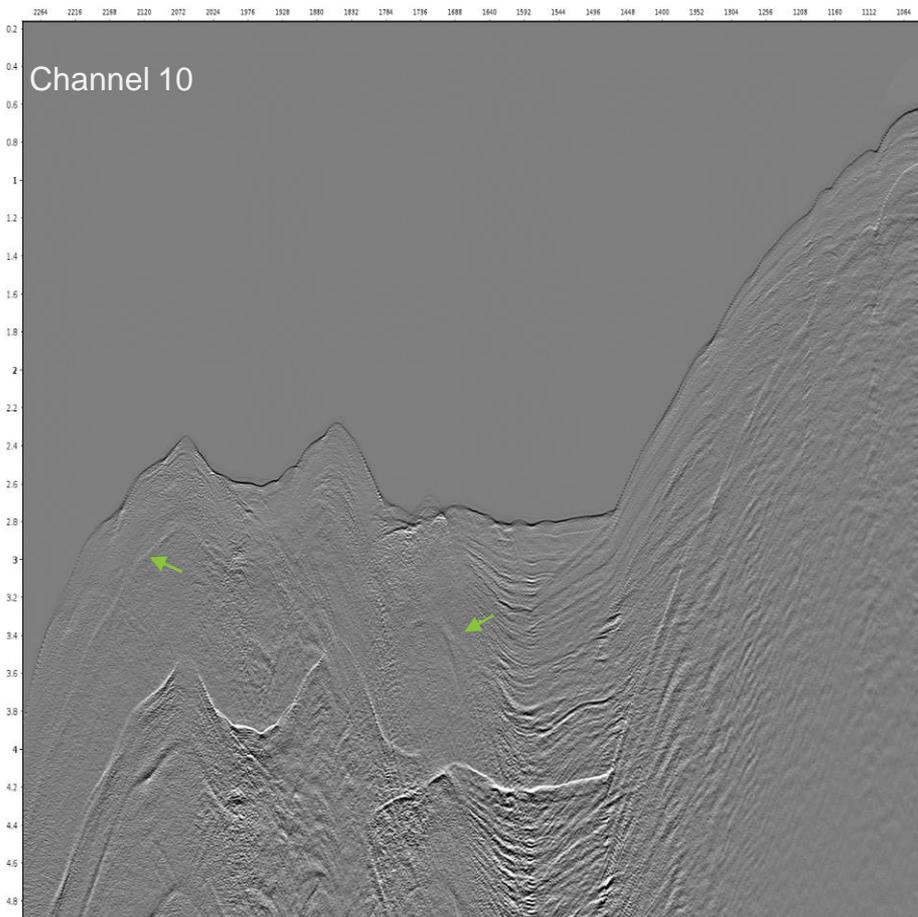


Difference before - after SRME & MWD Subtraction

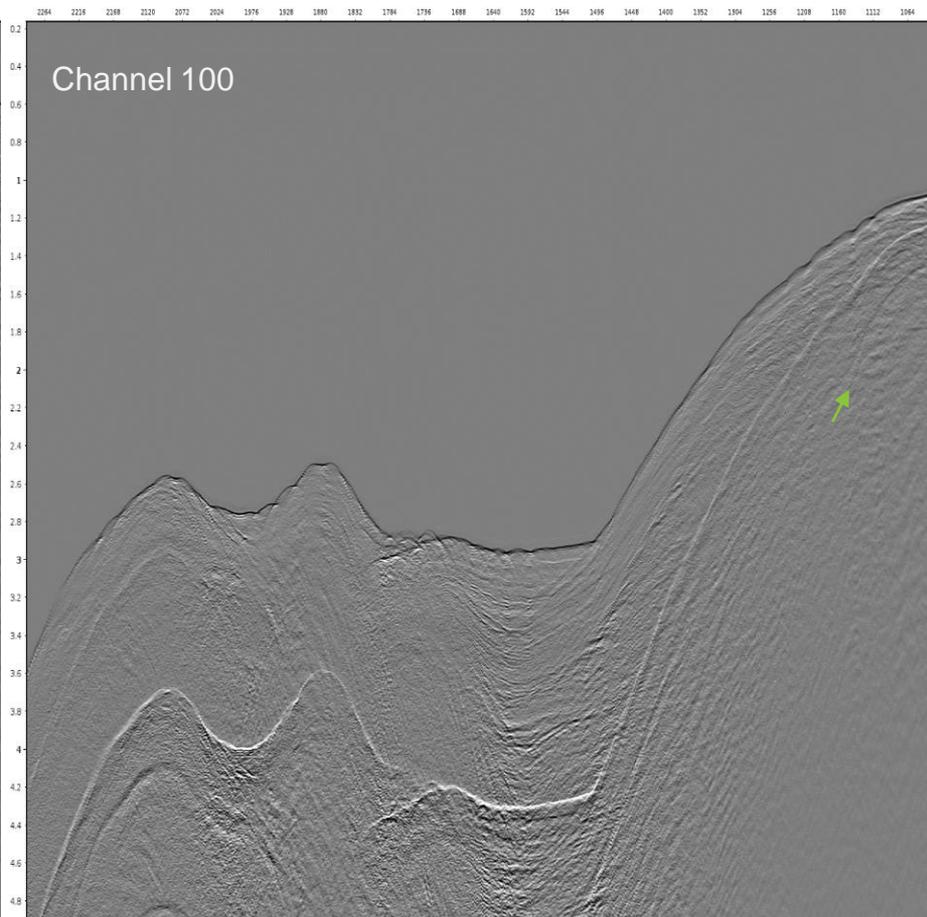




CABTR 10 / NAVSHOT

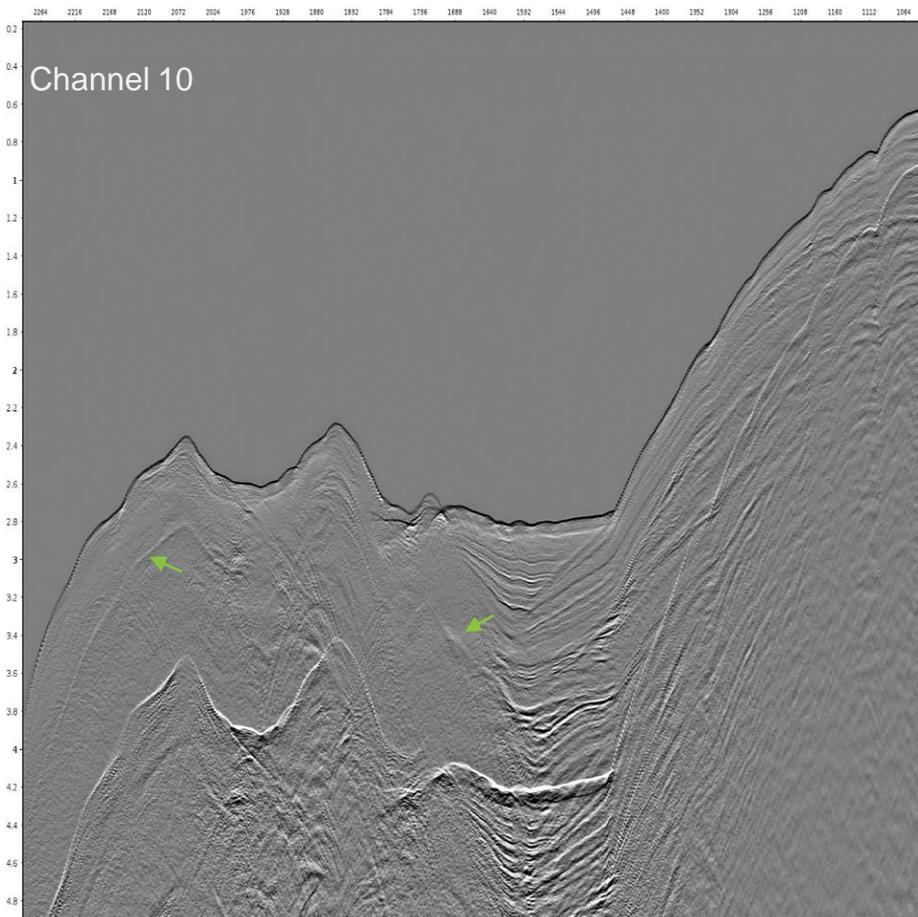


CABTR 100 / NAVSHOT

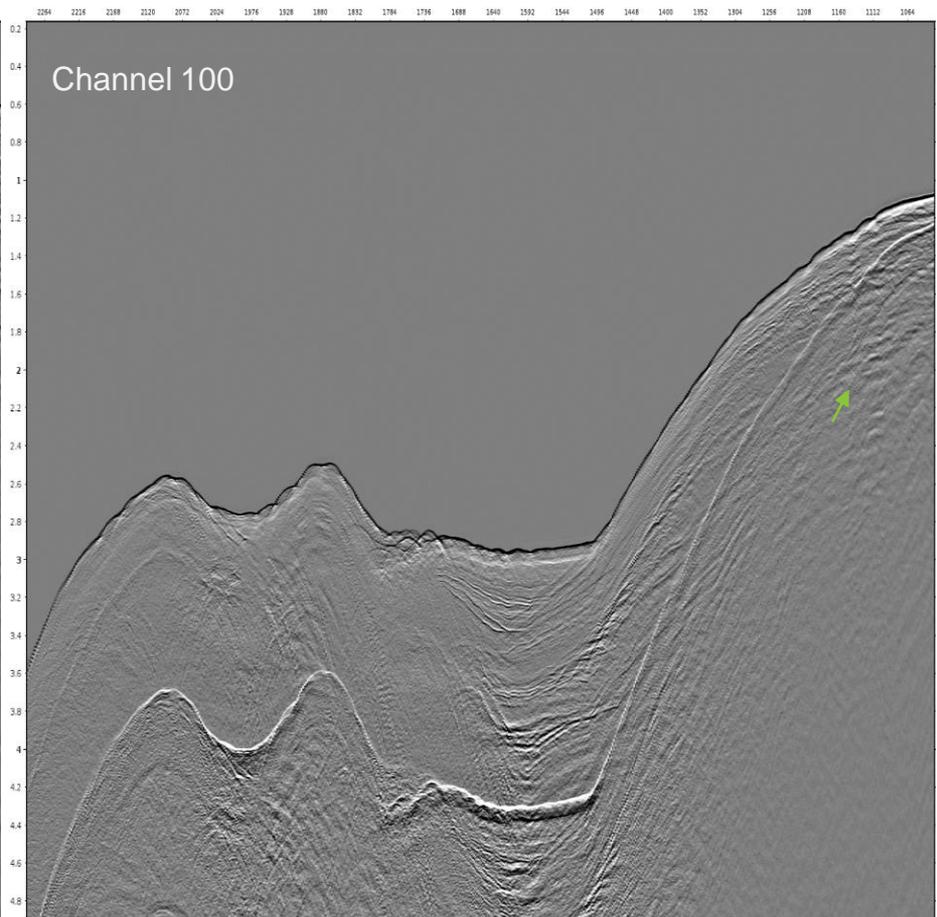


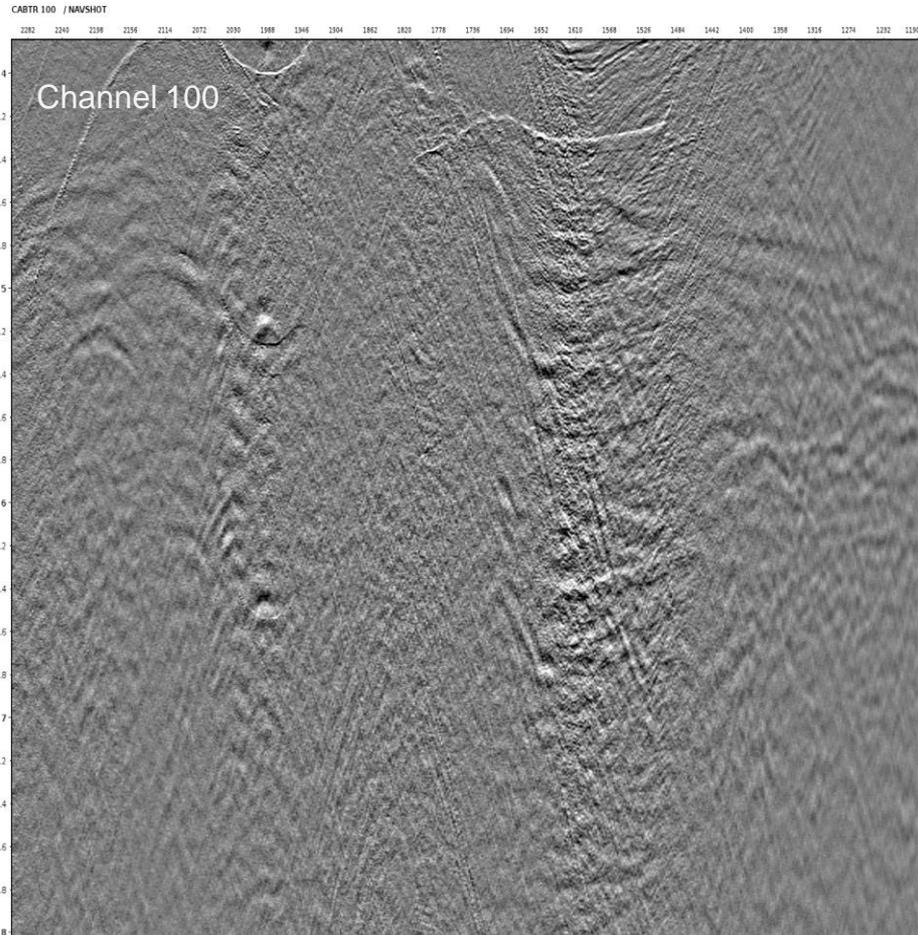
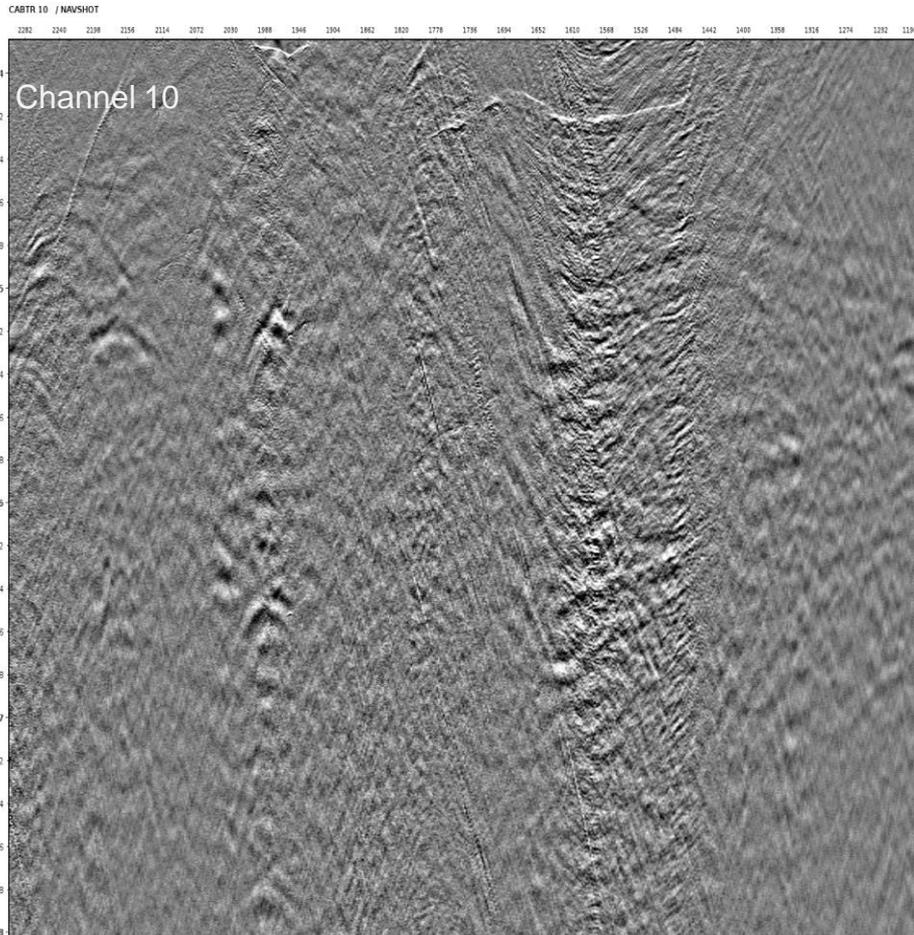


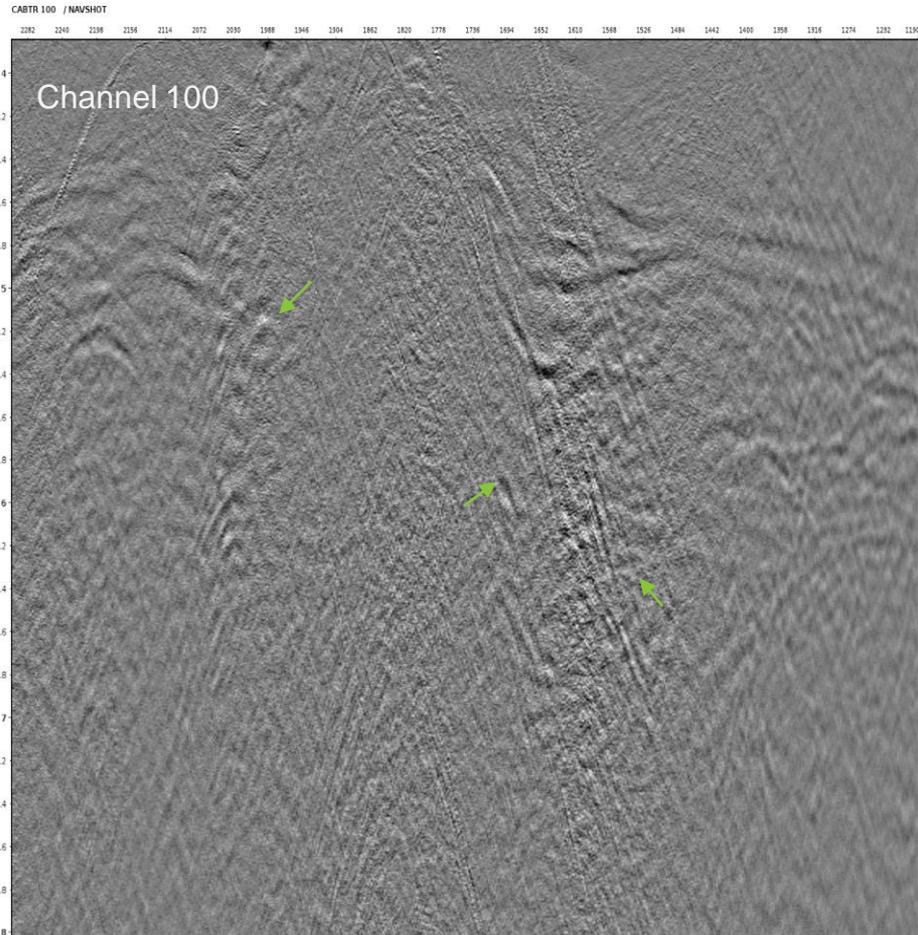
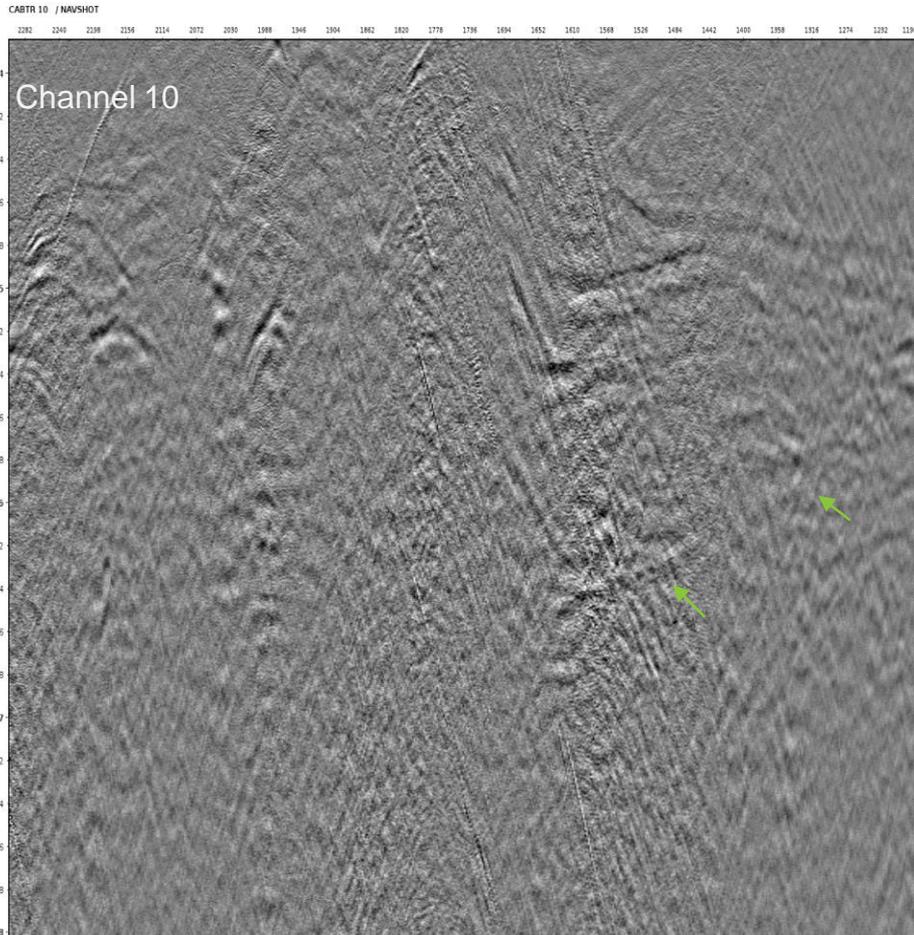
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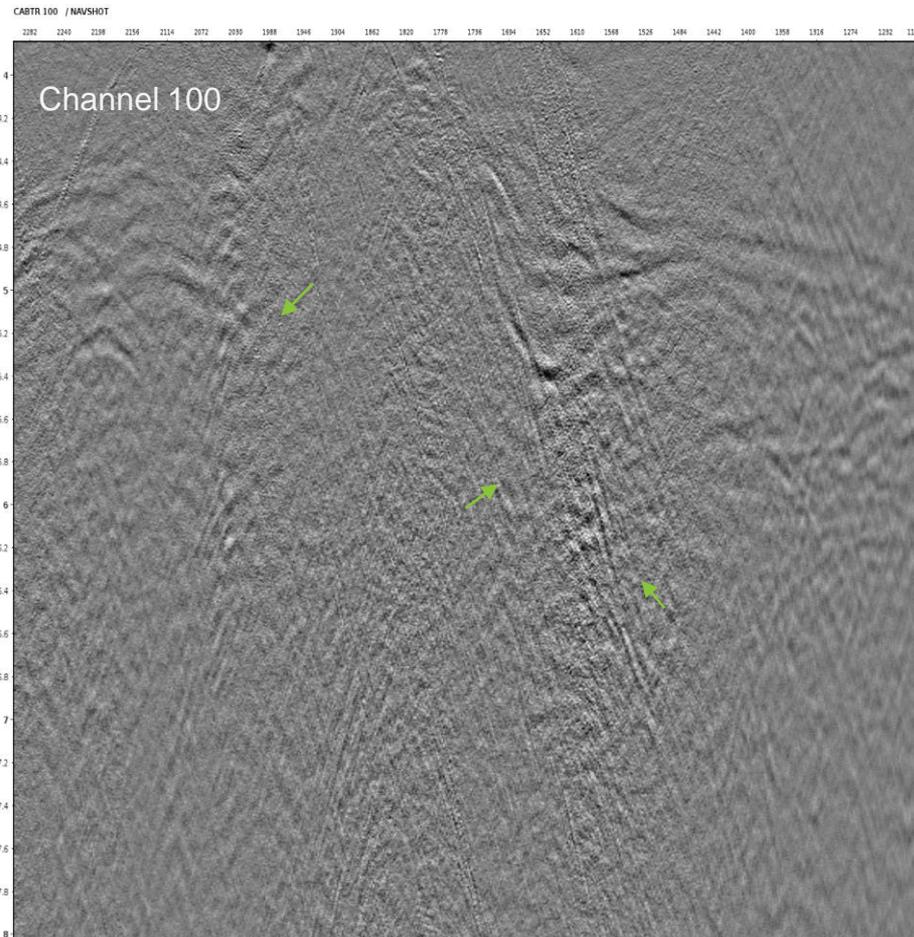
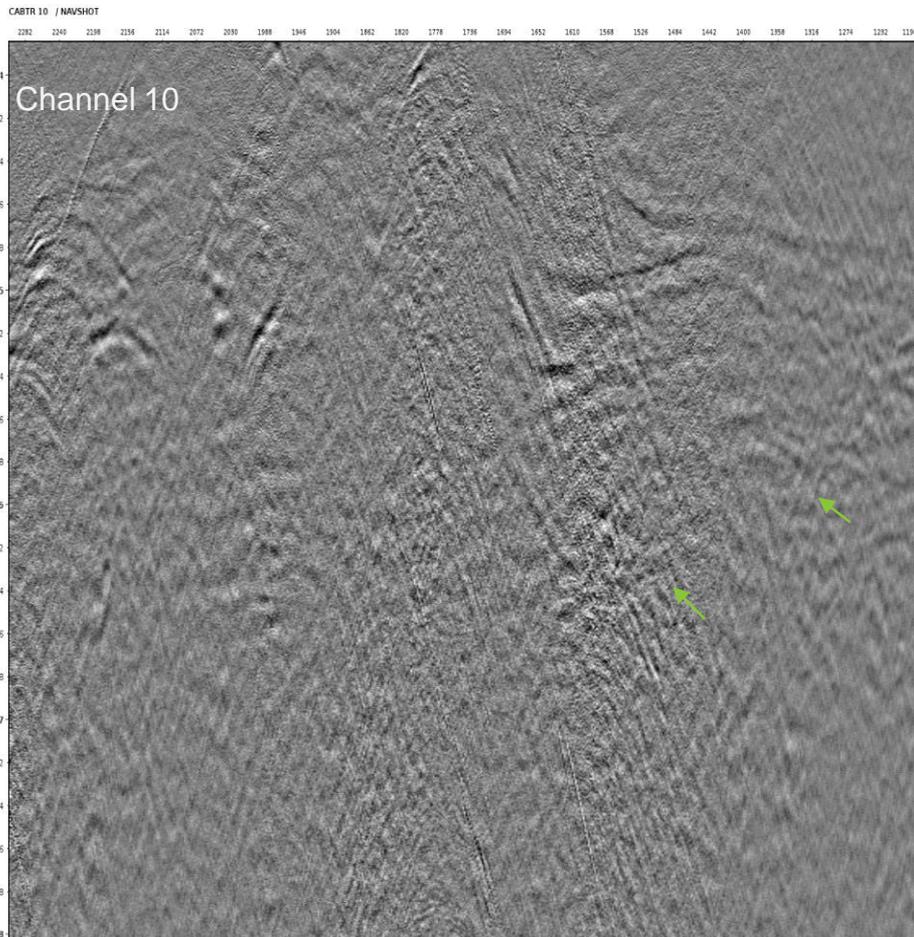


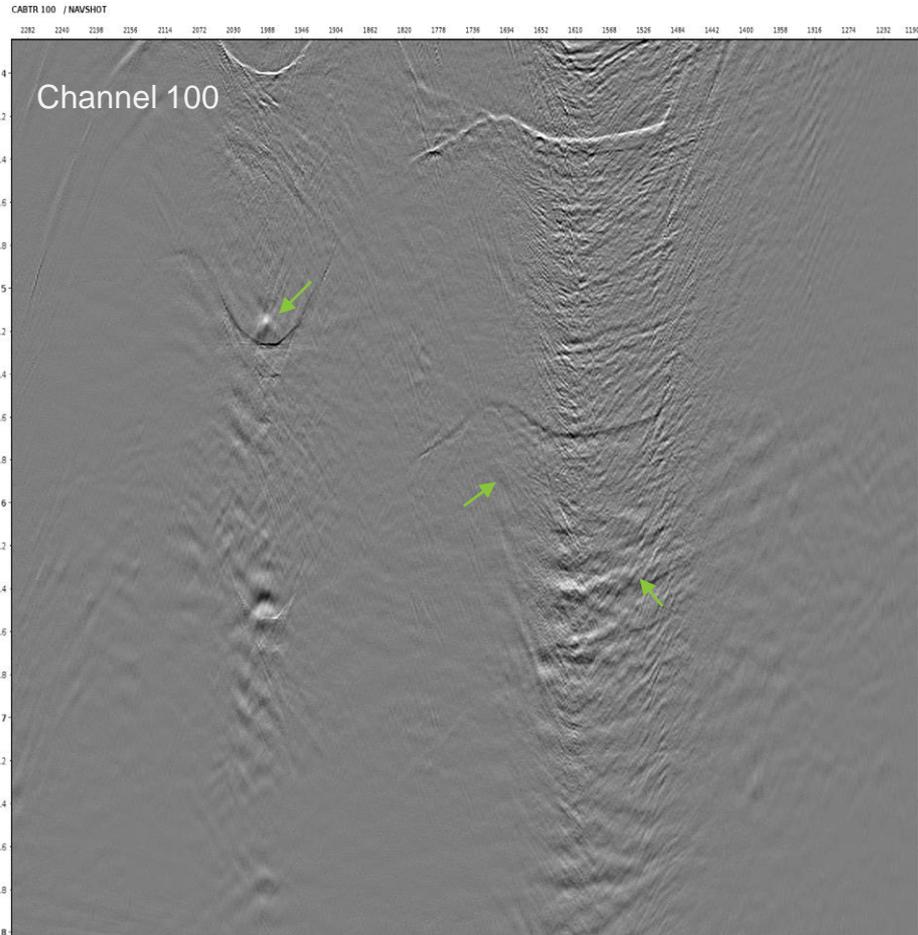
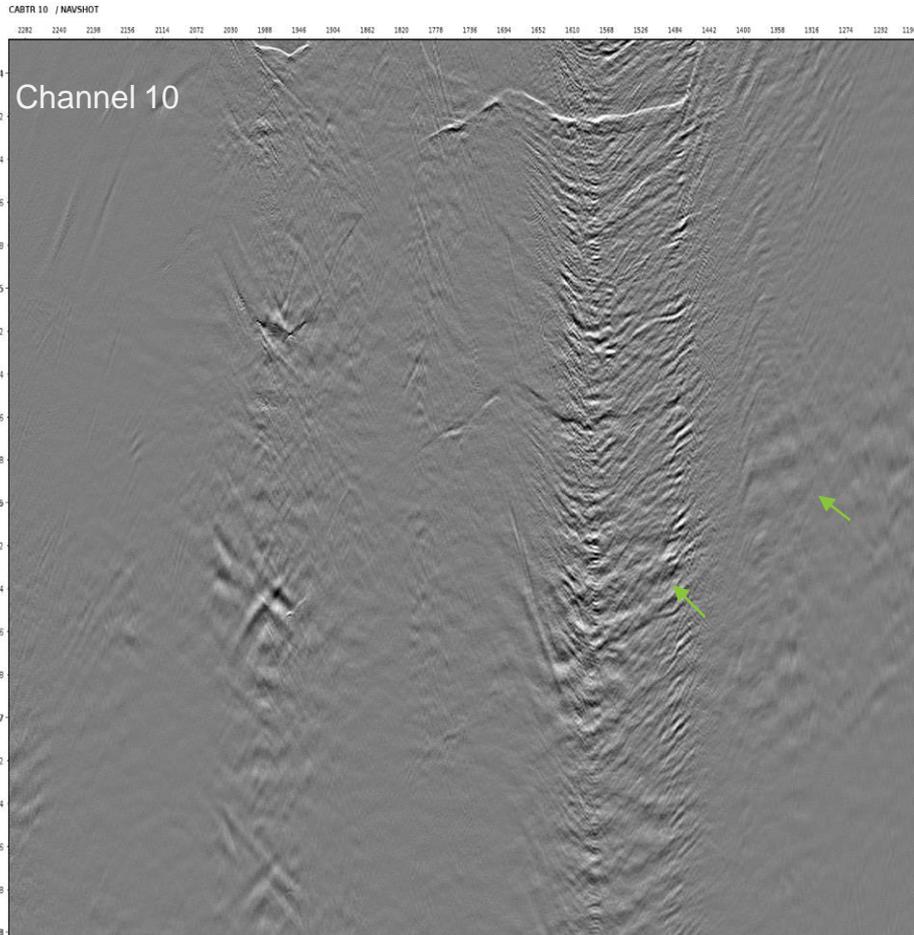
CABTR 100 / NAVSHOT

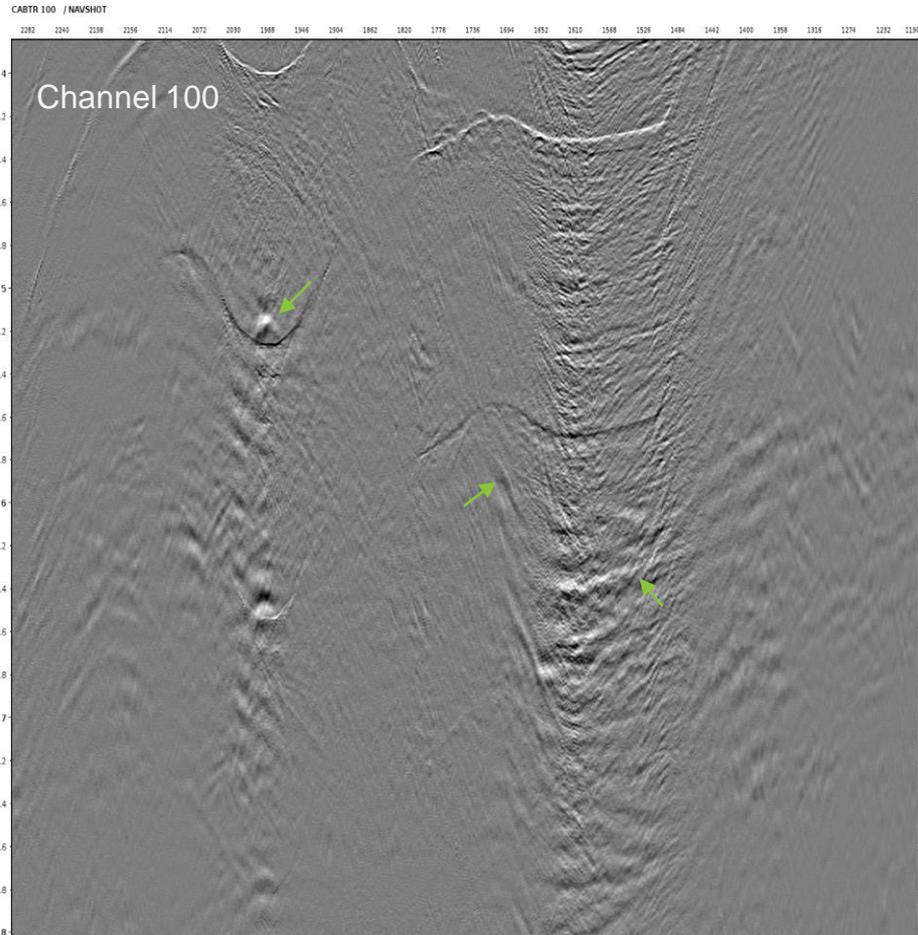
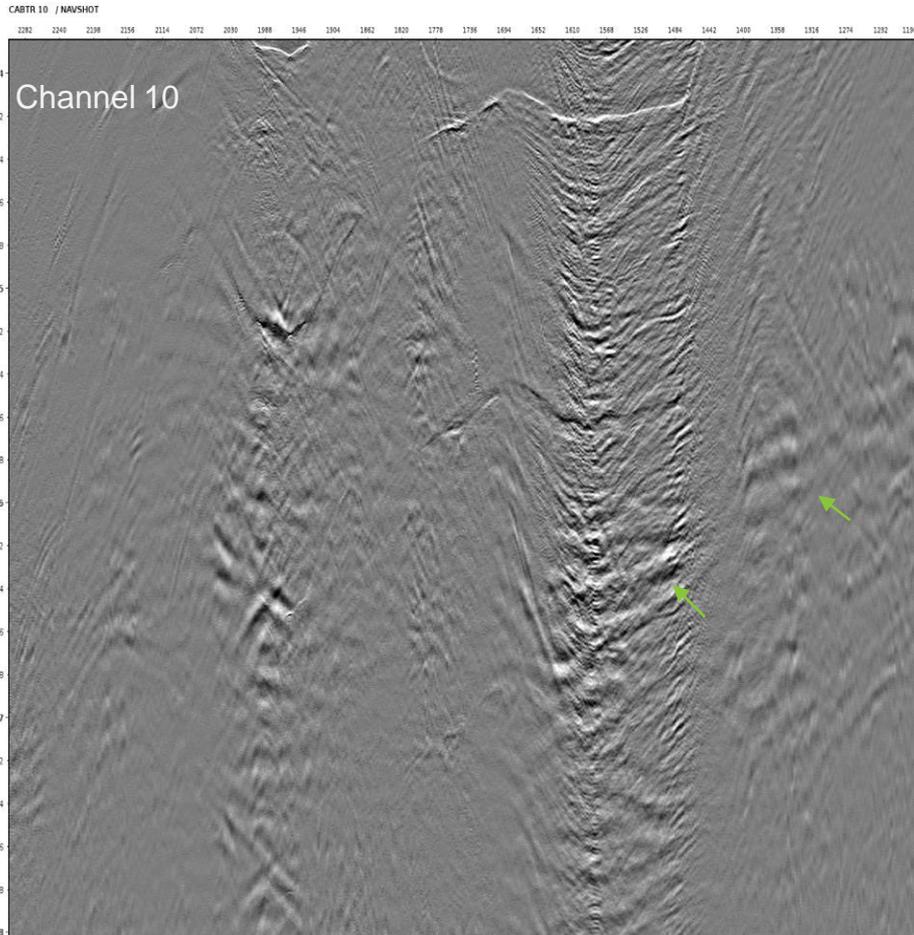






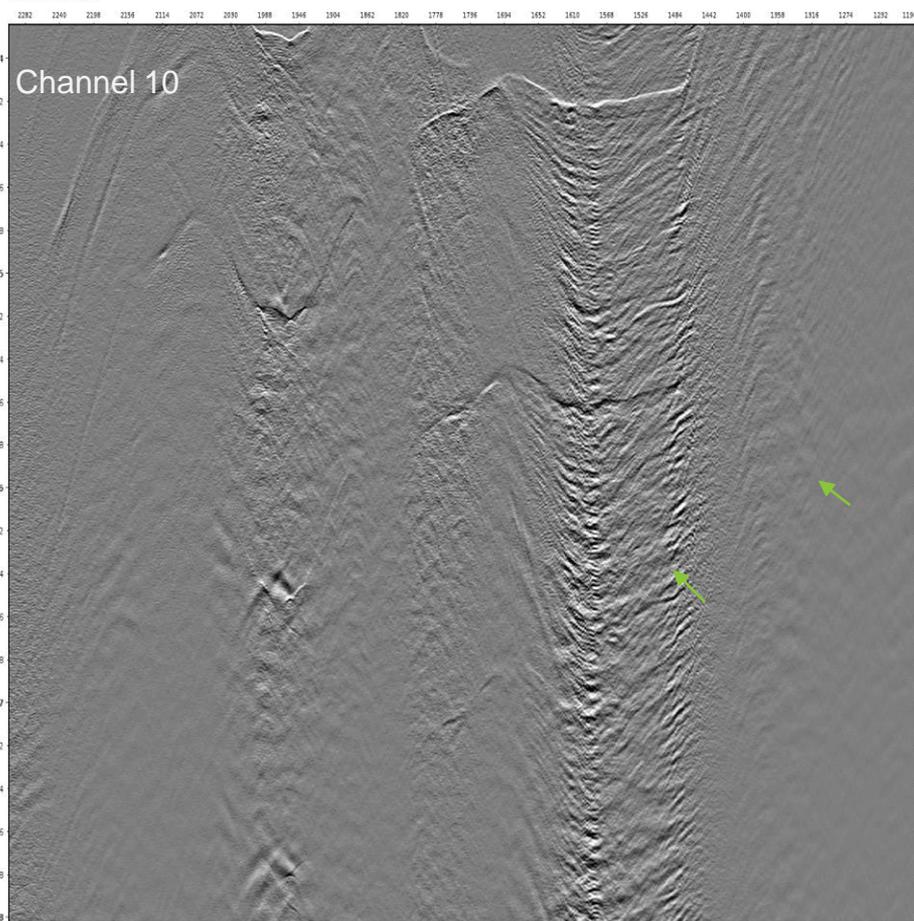




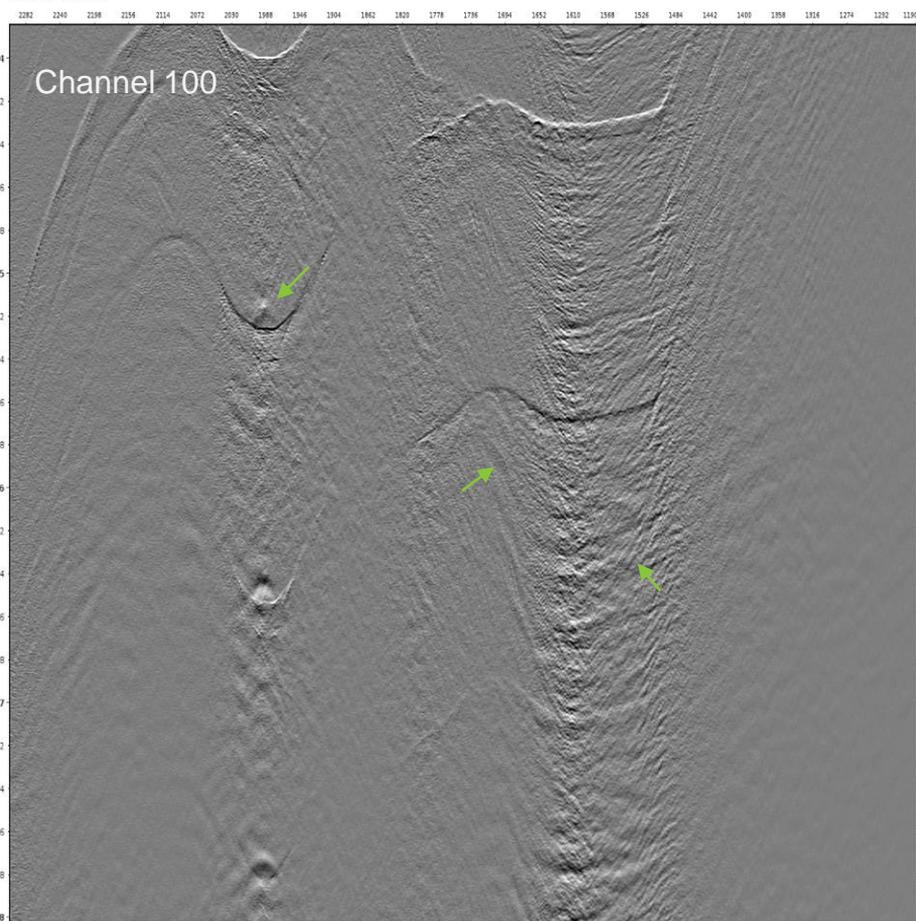




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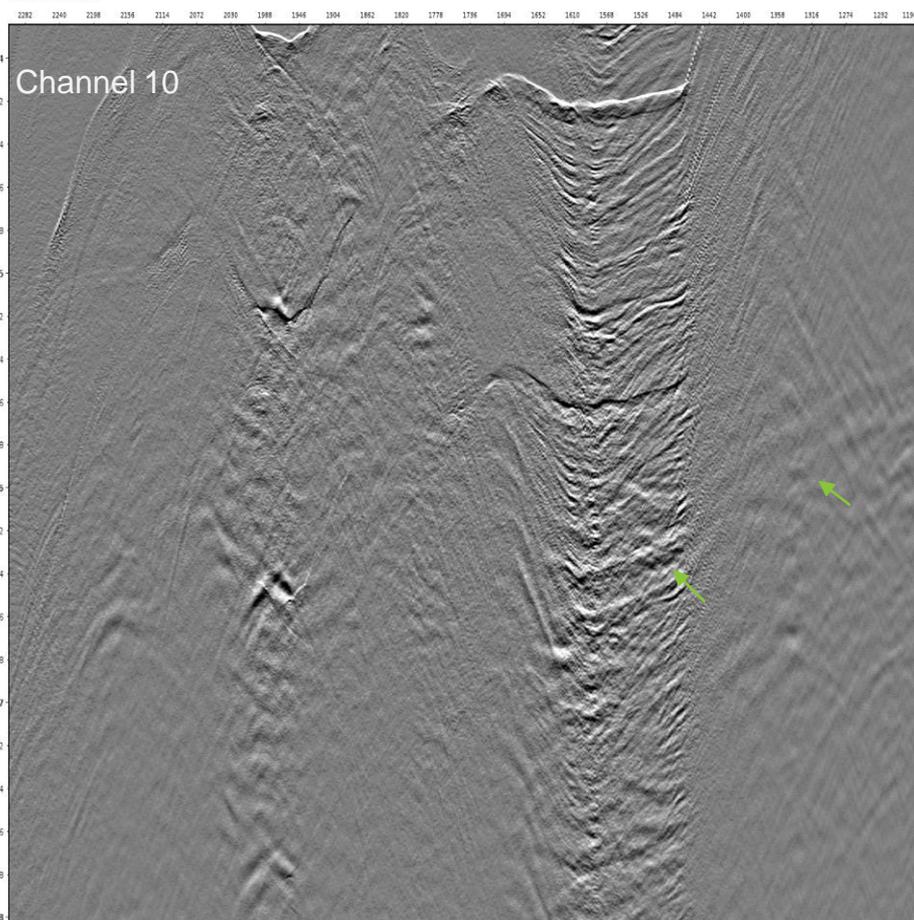


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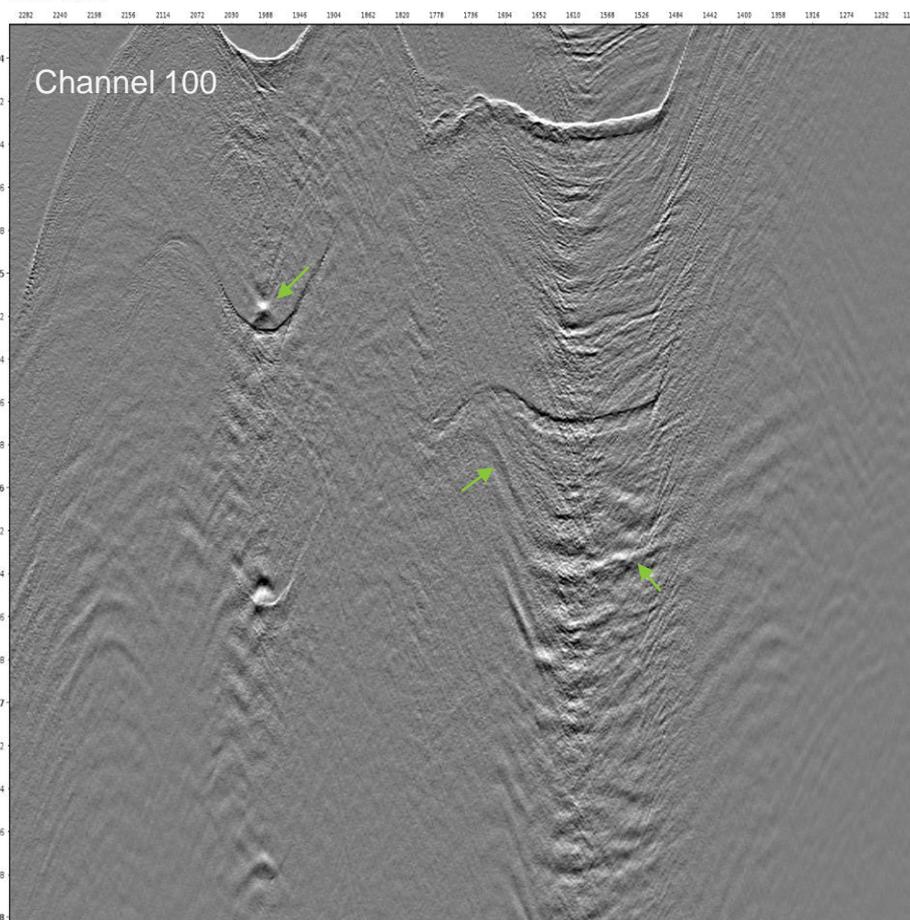




CABTR 10 / NAVSHOT



CABTR 100 / NAVSHOT



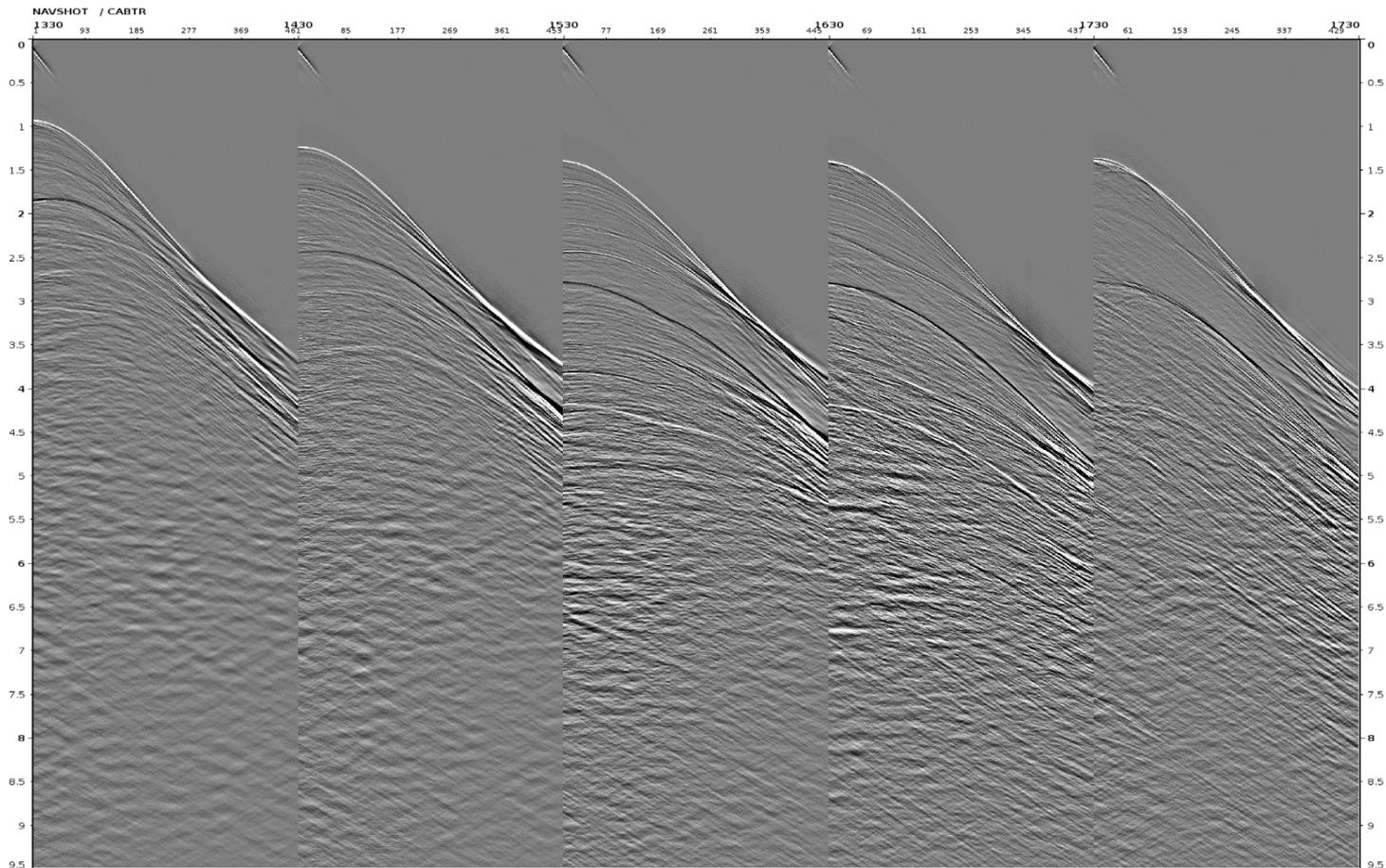
Seq 039

Stack

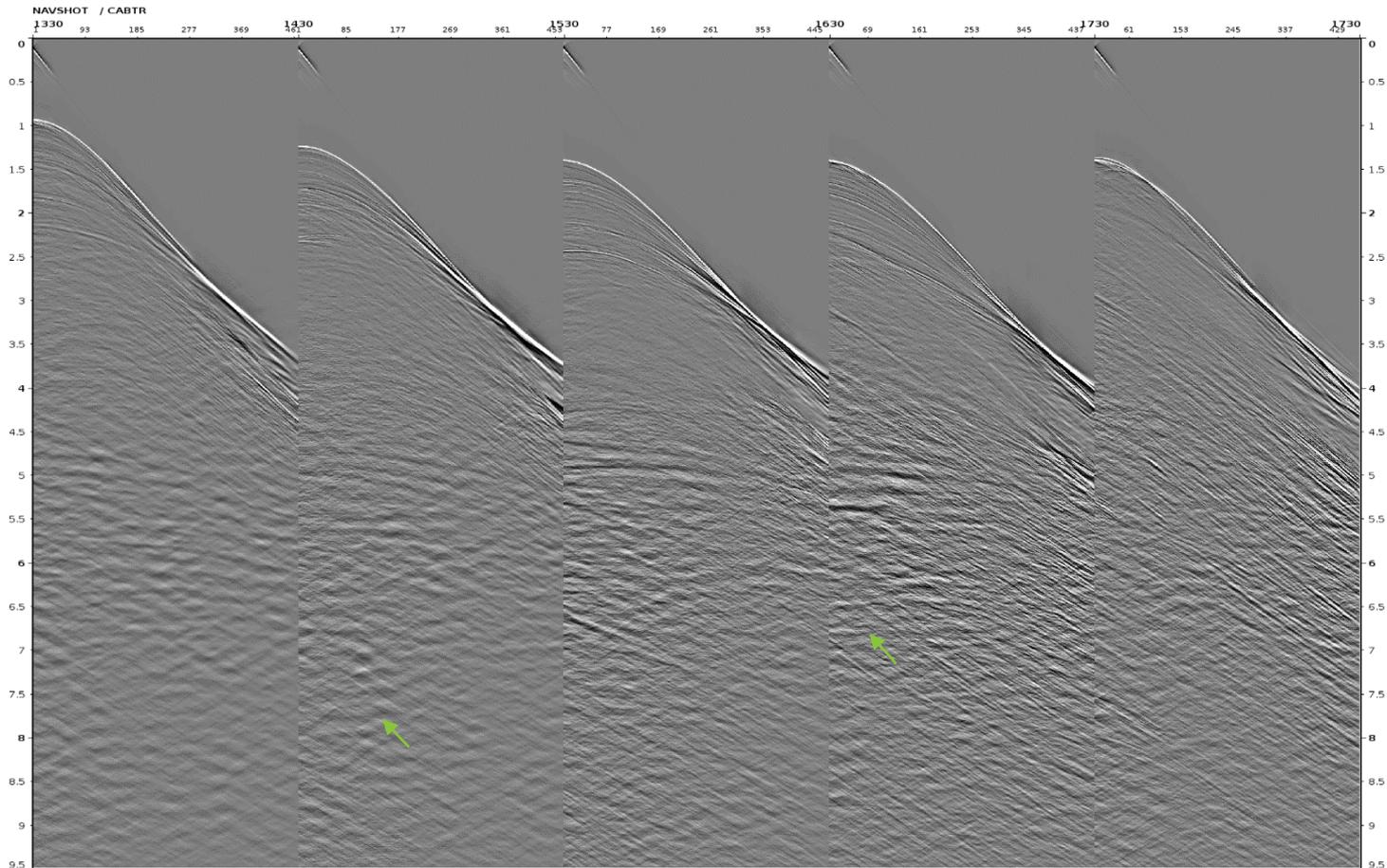
Common Channel

Shot Gathers

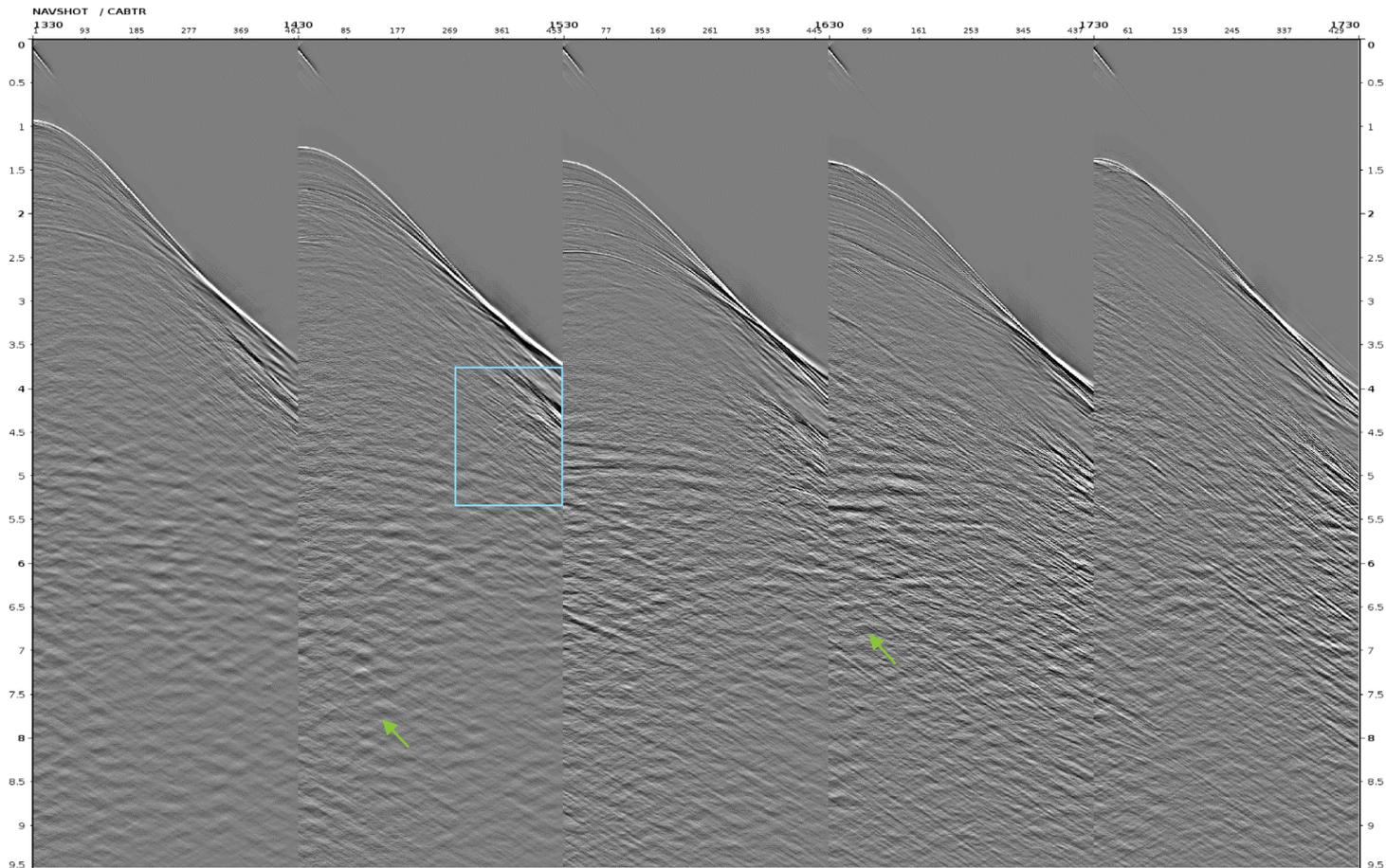




- Simultaneous subtraction flow with MWD & SRME shows benefits in surface related multiples removal and primaries protection.
- Far offset dipping residual will be further removed by “Radon” and residual LNA (Linear noise attenuation).

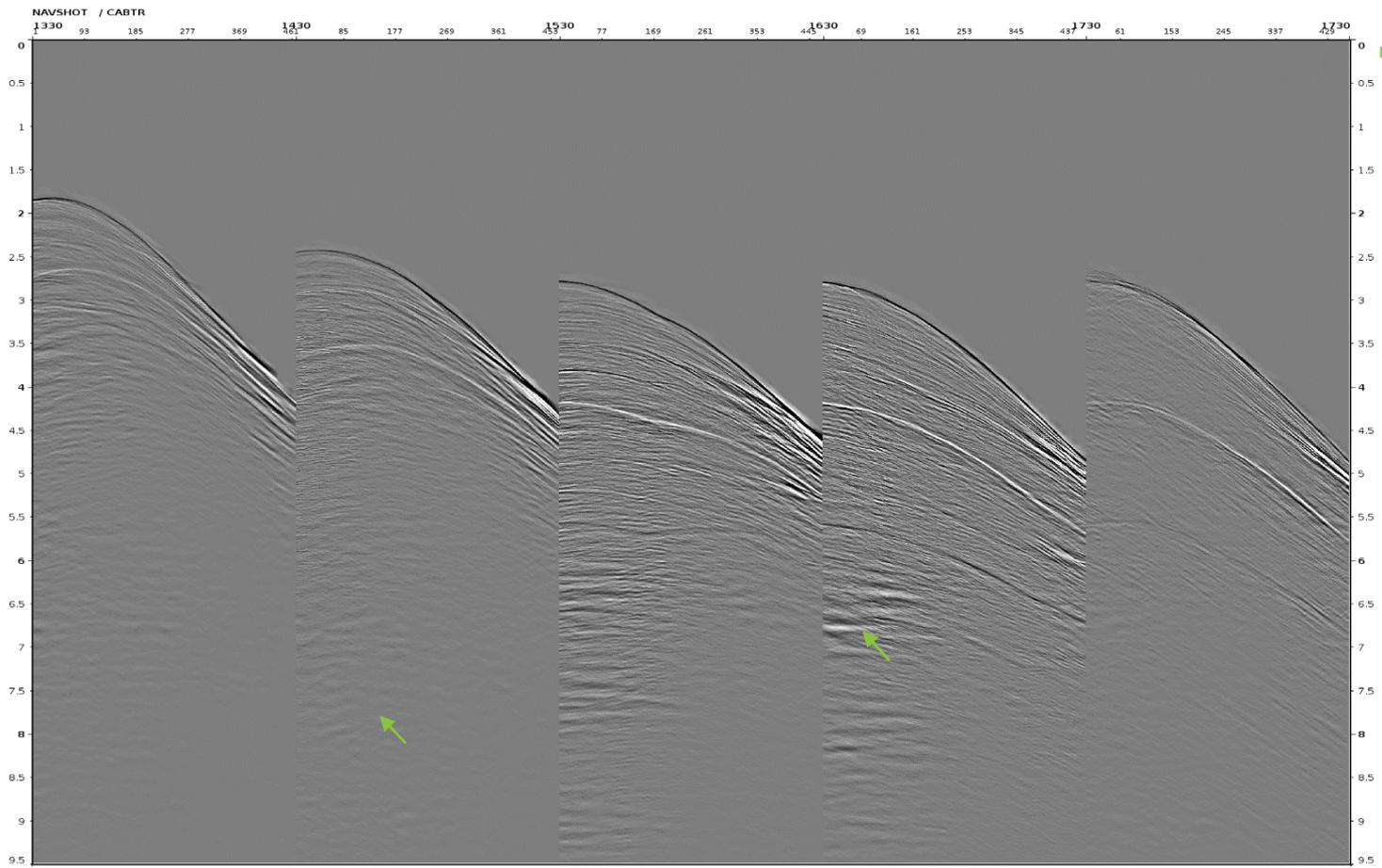


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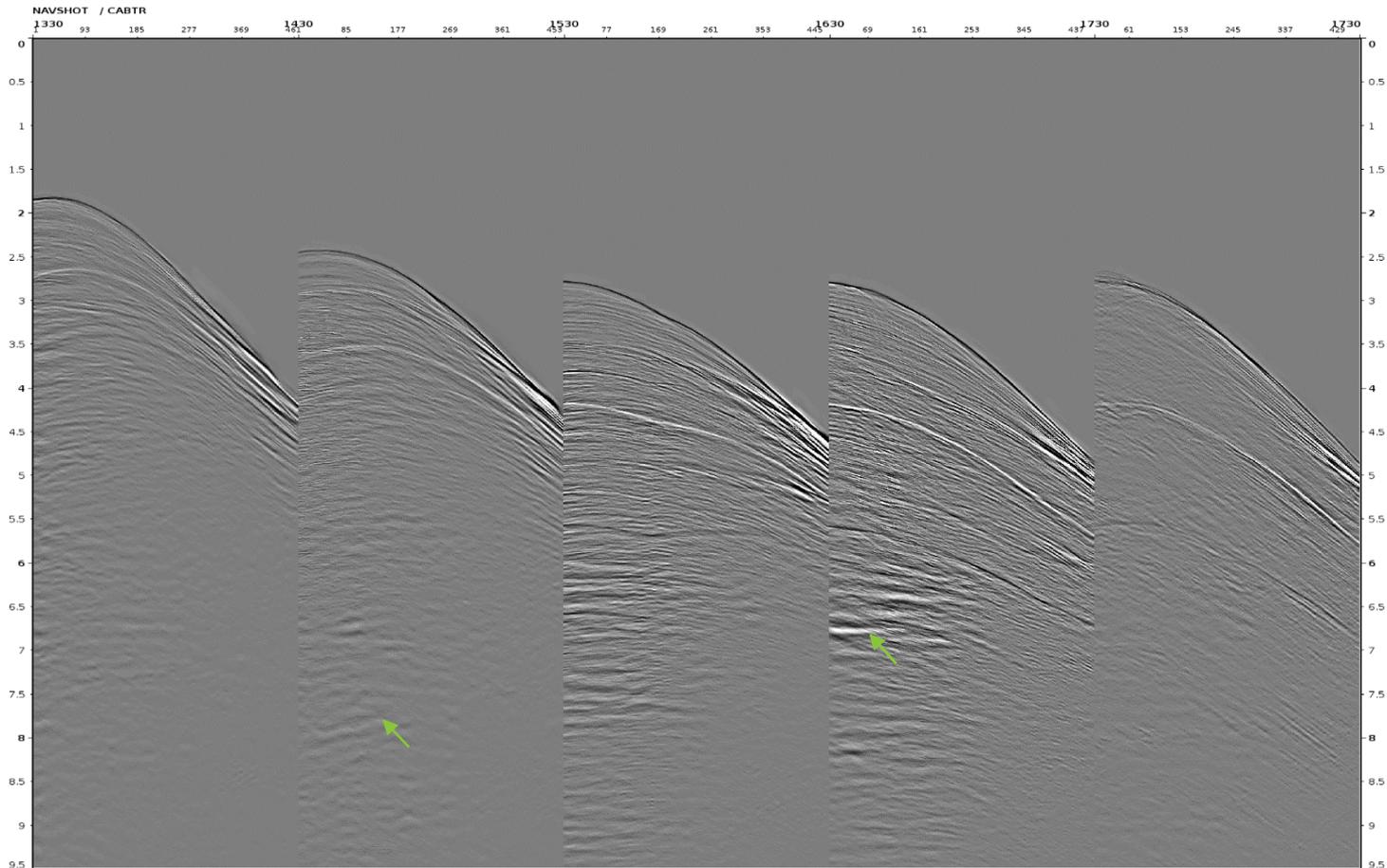


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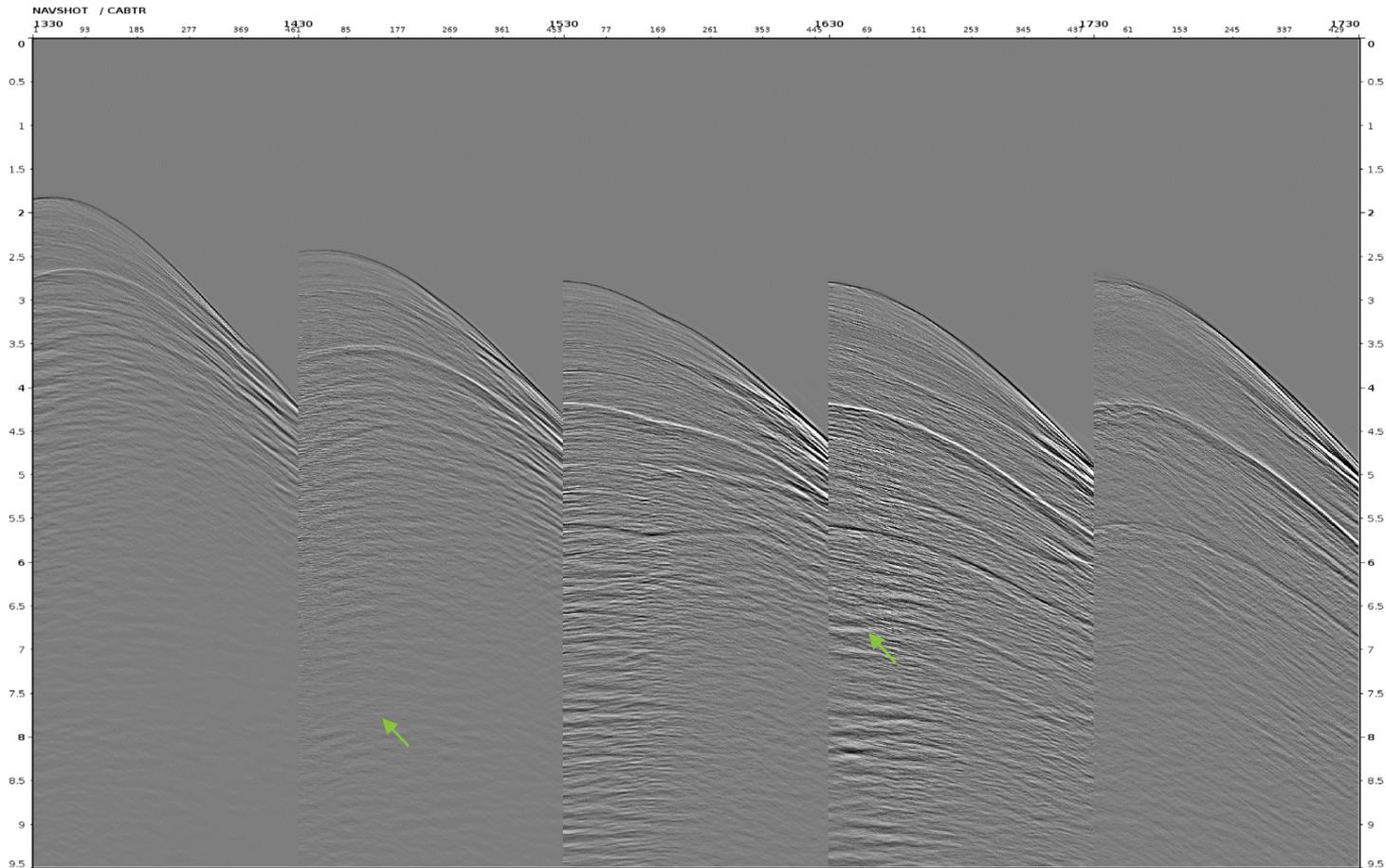
Difference before - after SRME Subtraction



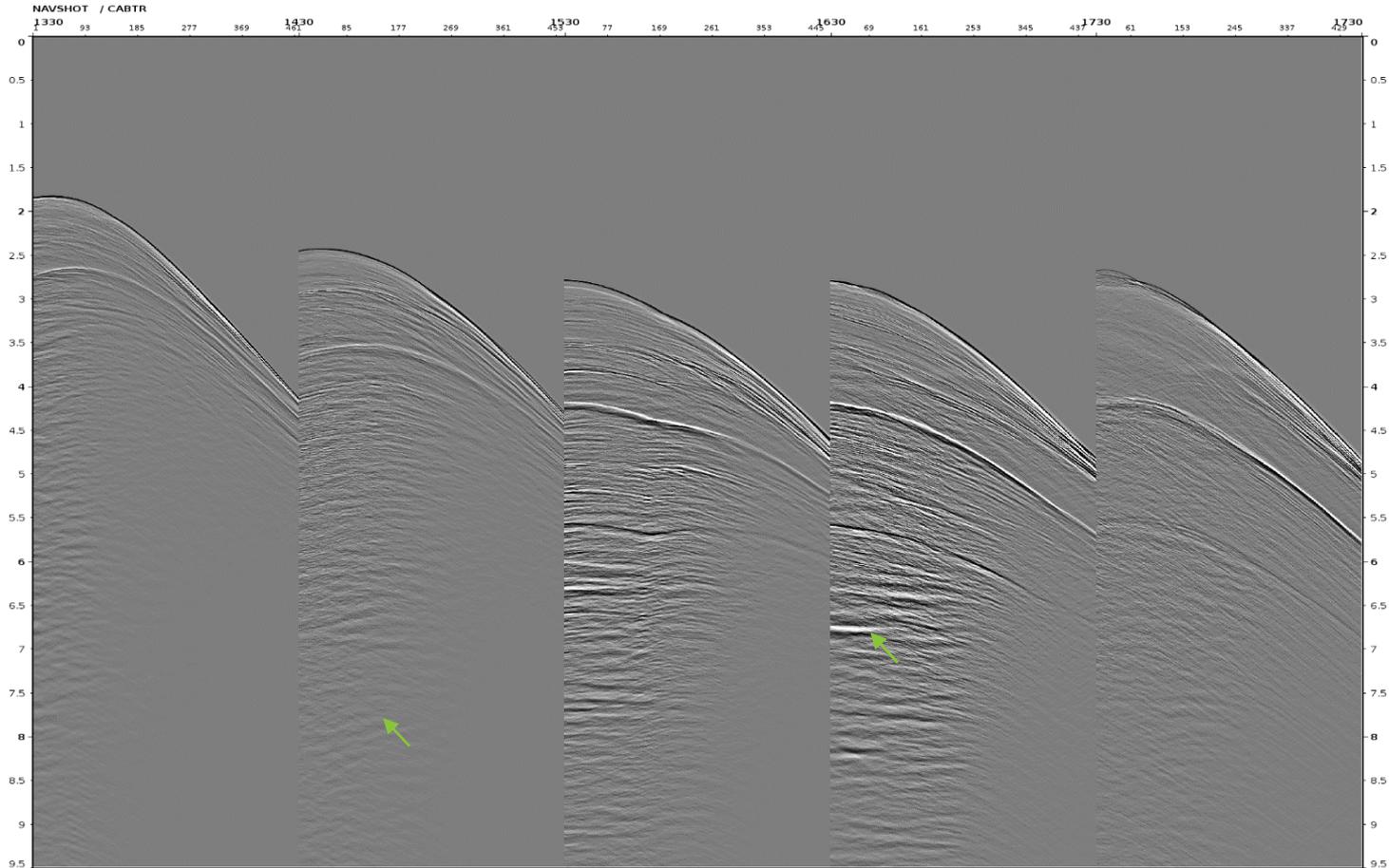
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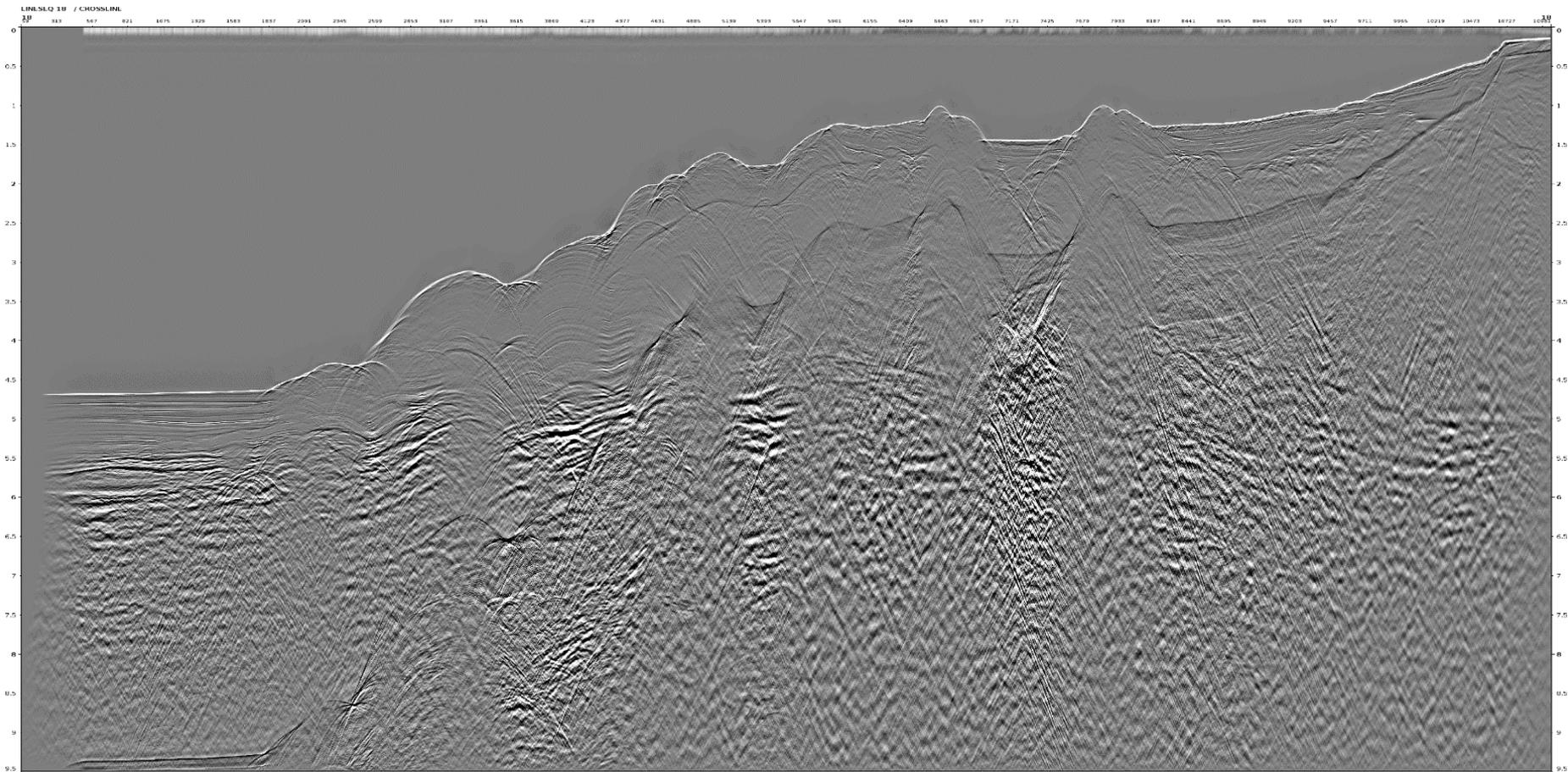
Seq 018

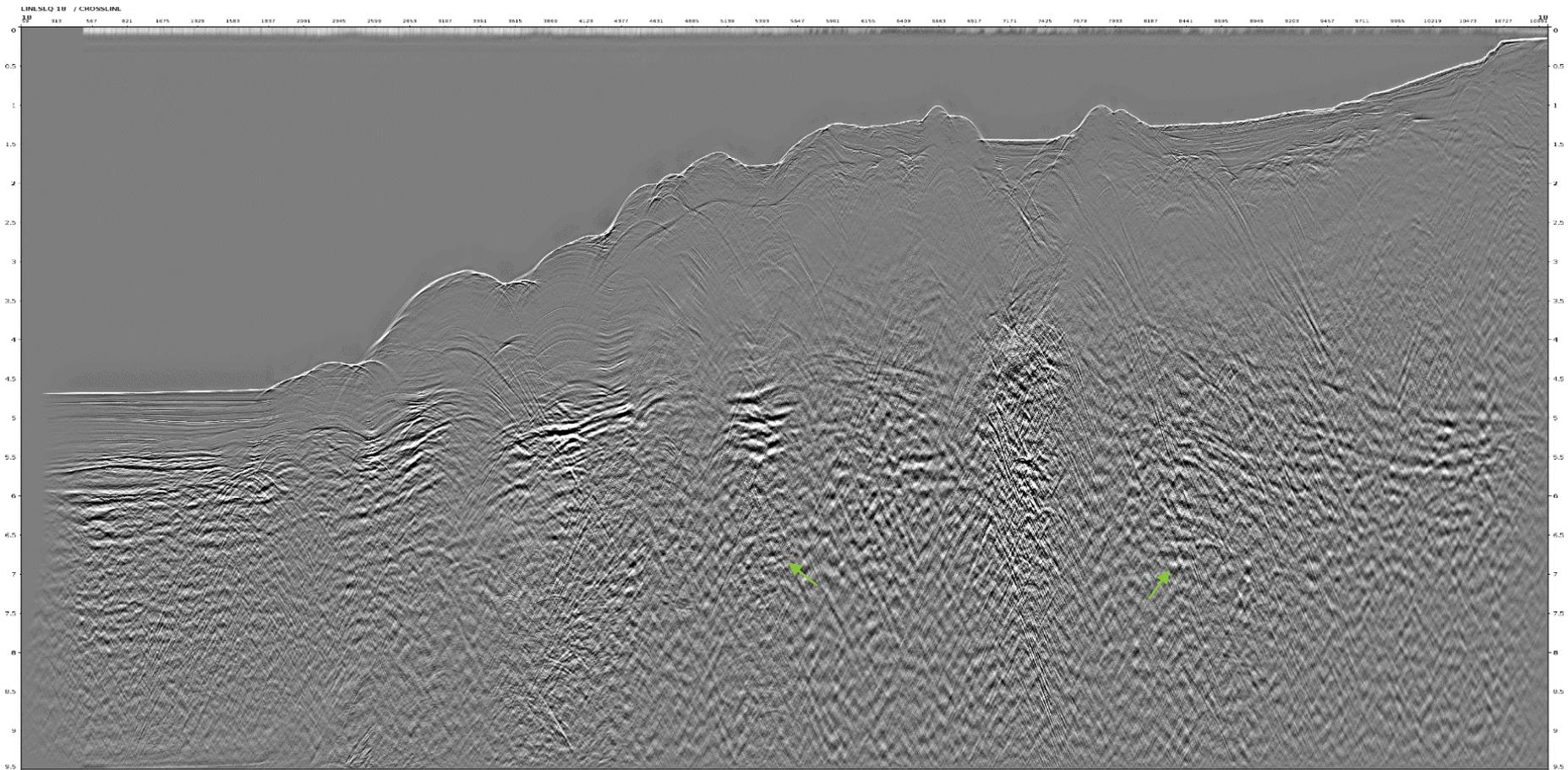
Stack

Common Channel

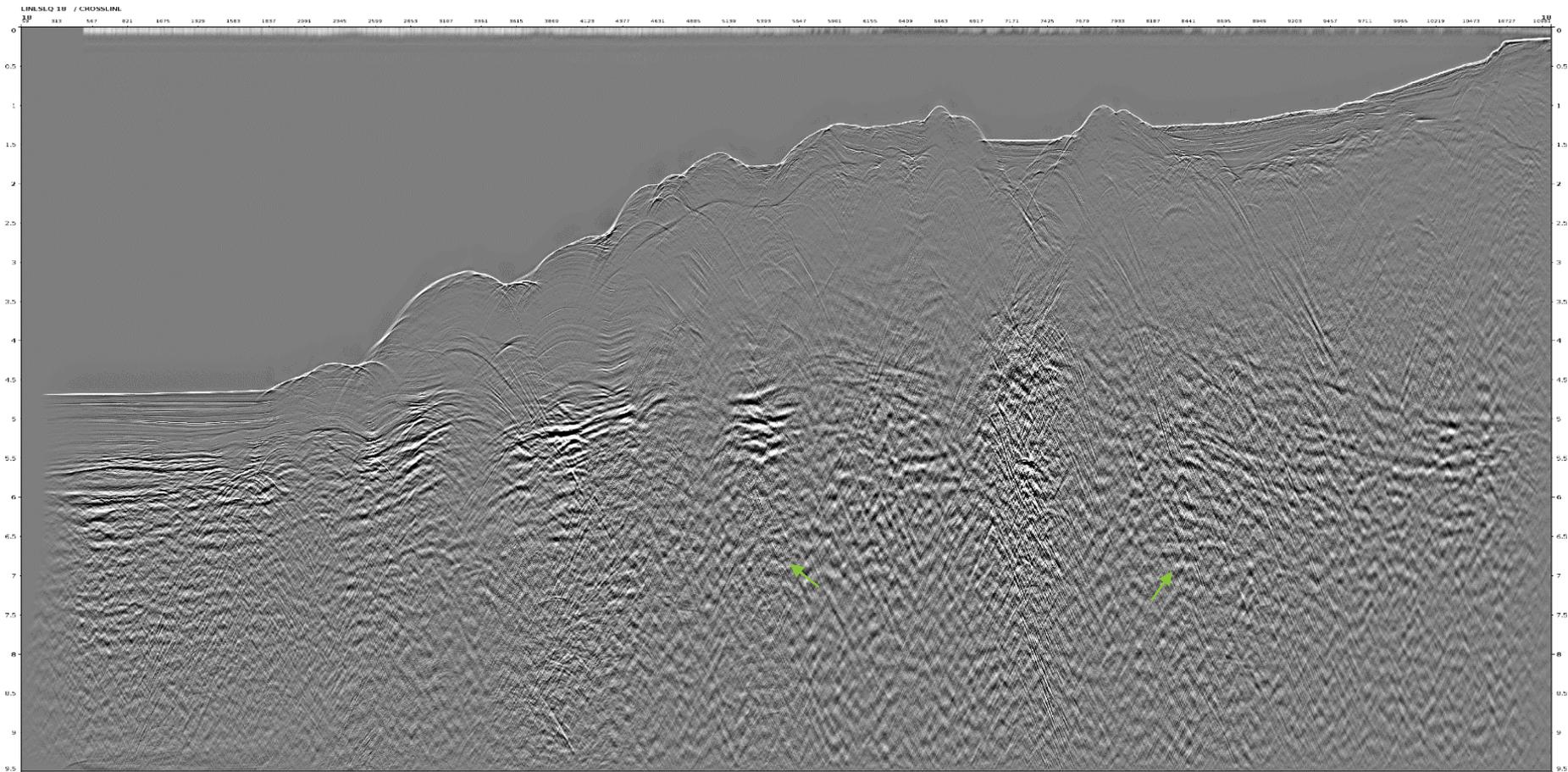
Shot Gathers







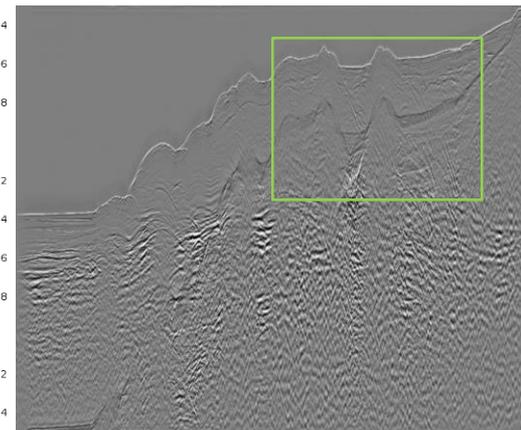
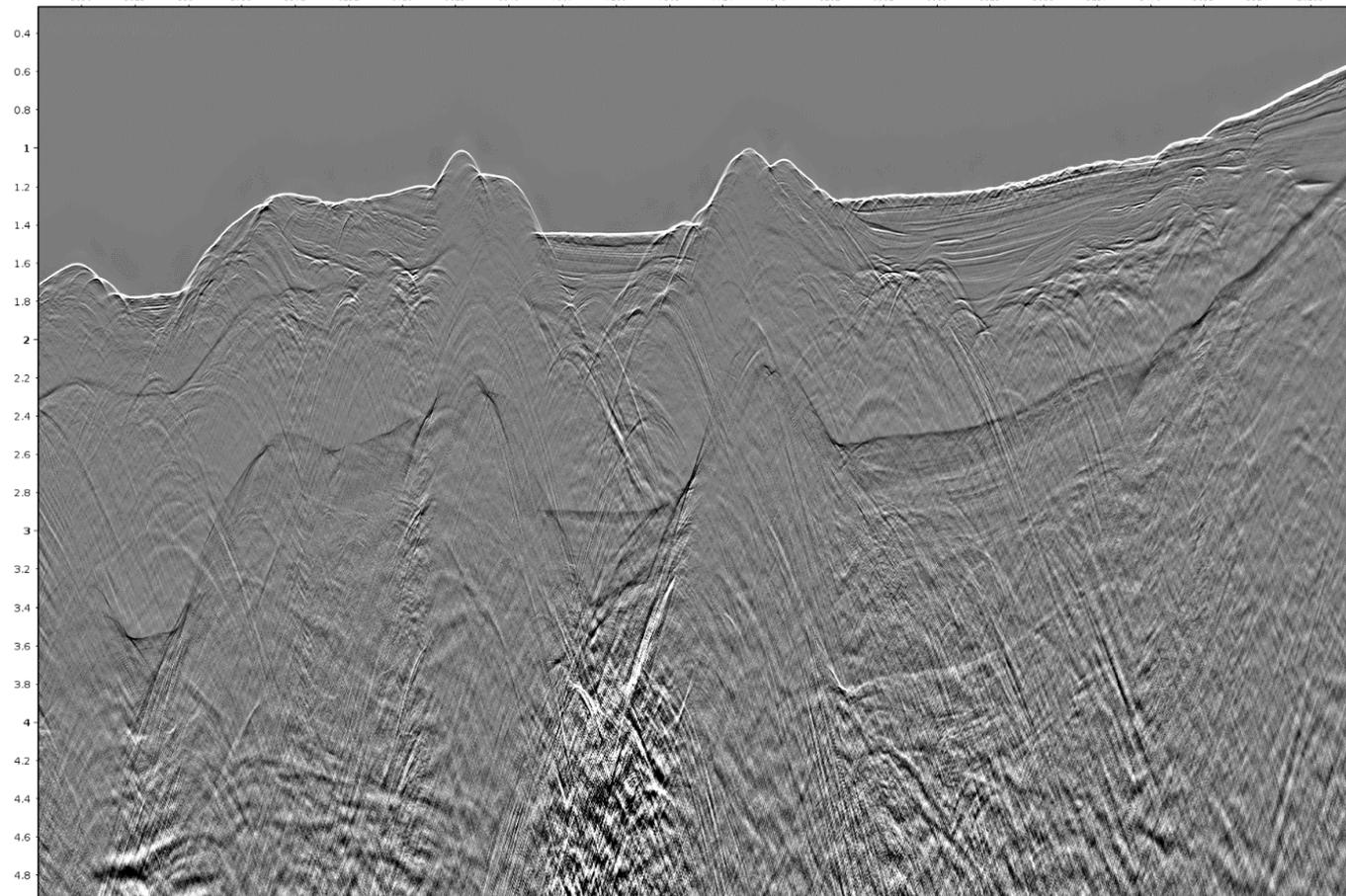
Stack after SRME & MWD Subtraction



Zoom in Stack before Subtraction

LINESEQ 18 / CROSSLINE

5096 5315 5534 5753 5972 6191 6410 6629 6848 7067 7286 7505 7724 7943 8162 8381 8600 8819 9038 9257 9476 9695 9914 10133

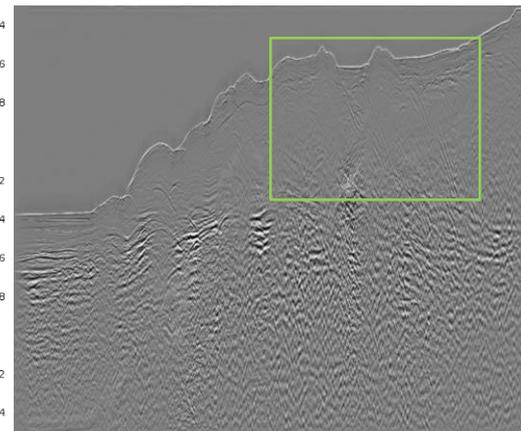
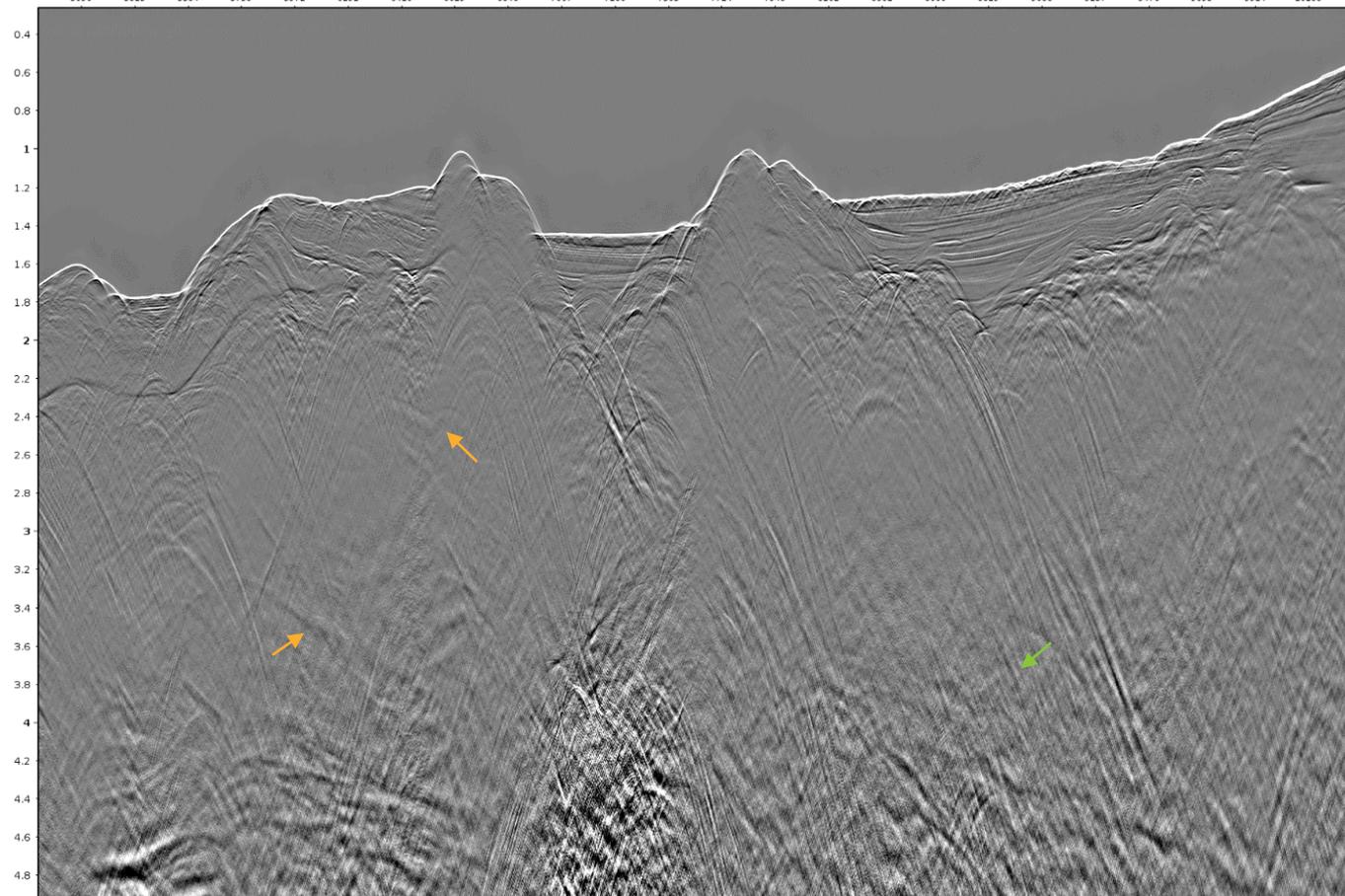


- Multiples are better attenuated with simultaneous subtraction.
- Primaries are protected by simultaneous subtraction flow.

Zoom in Stack after SRME Subtraction

LINESEQ 18 / CROSSLINE

5096 5315 5534 5753 5972 6191 6410 6629 6848 7067 7286 7505 7724 7943 8162 8381 8600 8819 9038 9257 9476 9695 9914 10133

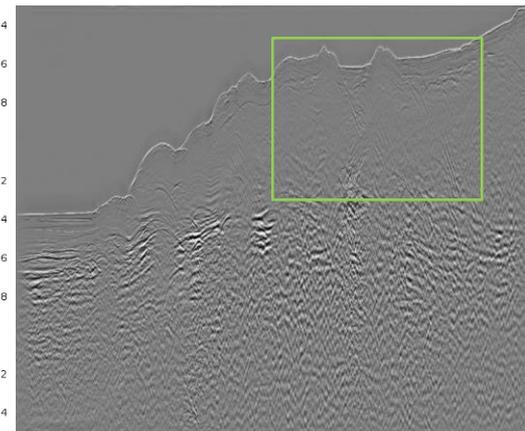
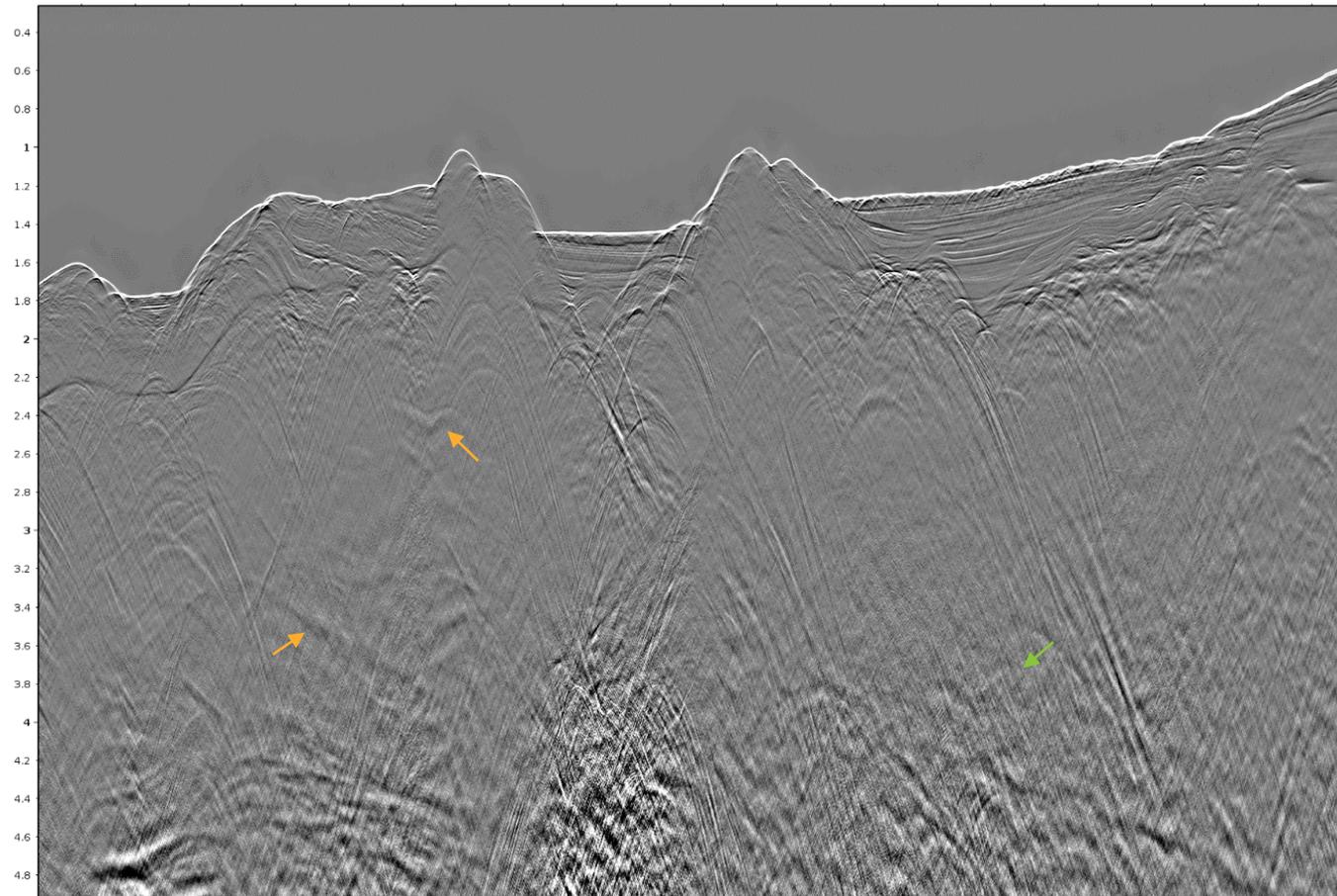


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Zoom in Stack after SRME & MWD Subtraction

LINESEQ 18 / CROSSLINE
5096 5315 5534 5753 5972 6191 6410 6629 6848 7067 7286 7505 7724 7943 8162 8381 8600 8819 9038 9257 9476 9695 9914 10133

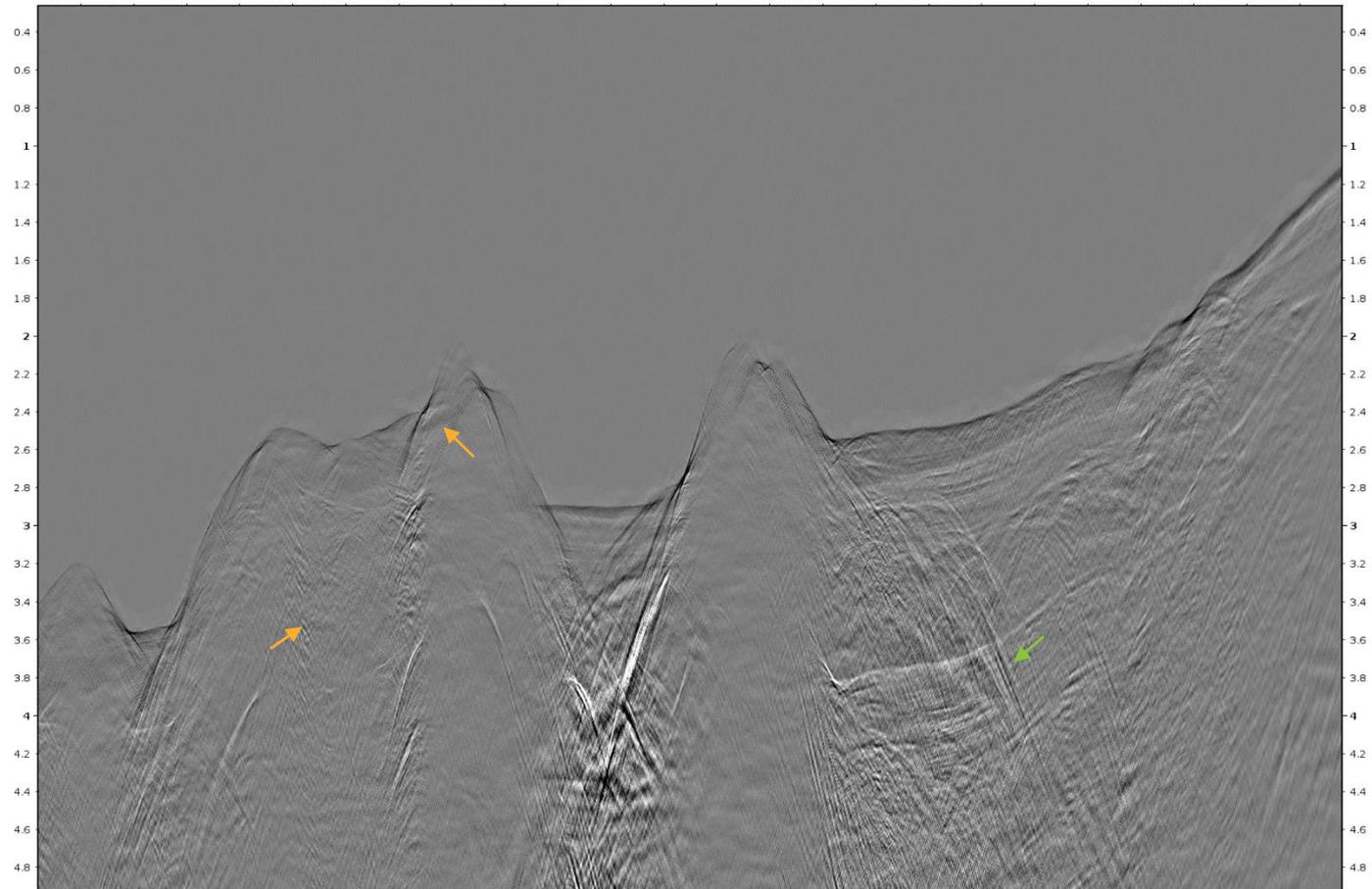


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Difference before – after SRME Subtraction

LINESEQ 18 / CROSSLINE

5096 5315 5534 5753 5972 6191 6410 6629 6848 7067 7286 7505 7724 7943 8162 8381 8600 8819 9038 9257 9476 9695 9914 10133

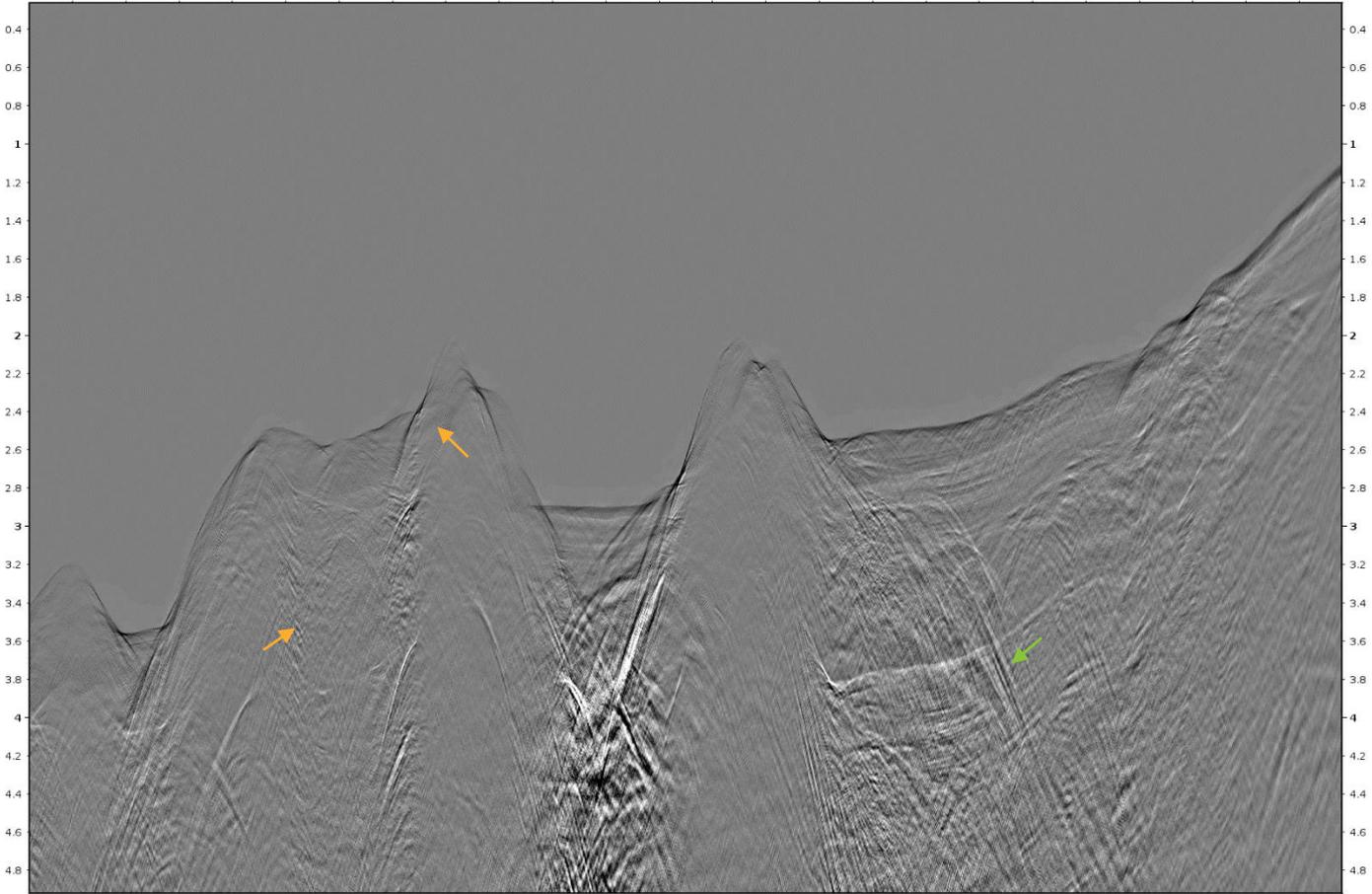




Difference before – after SRME & MWD Subtraction

LINESEQ 18 / CROSSLINE

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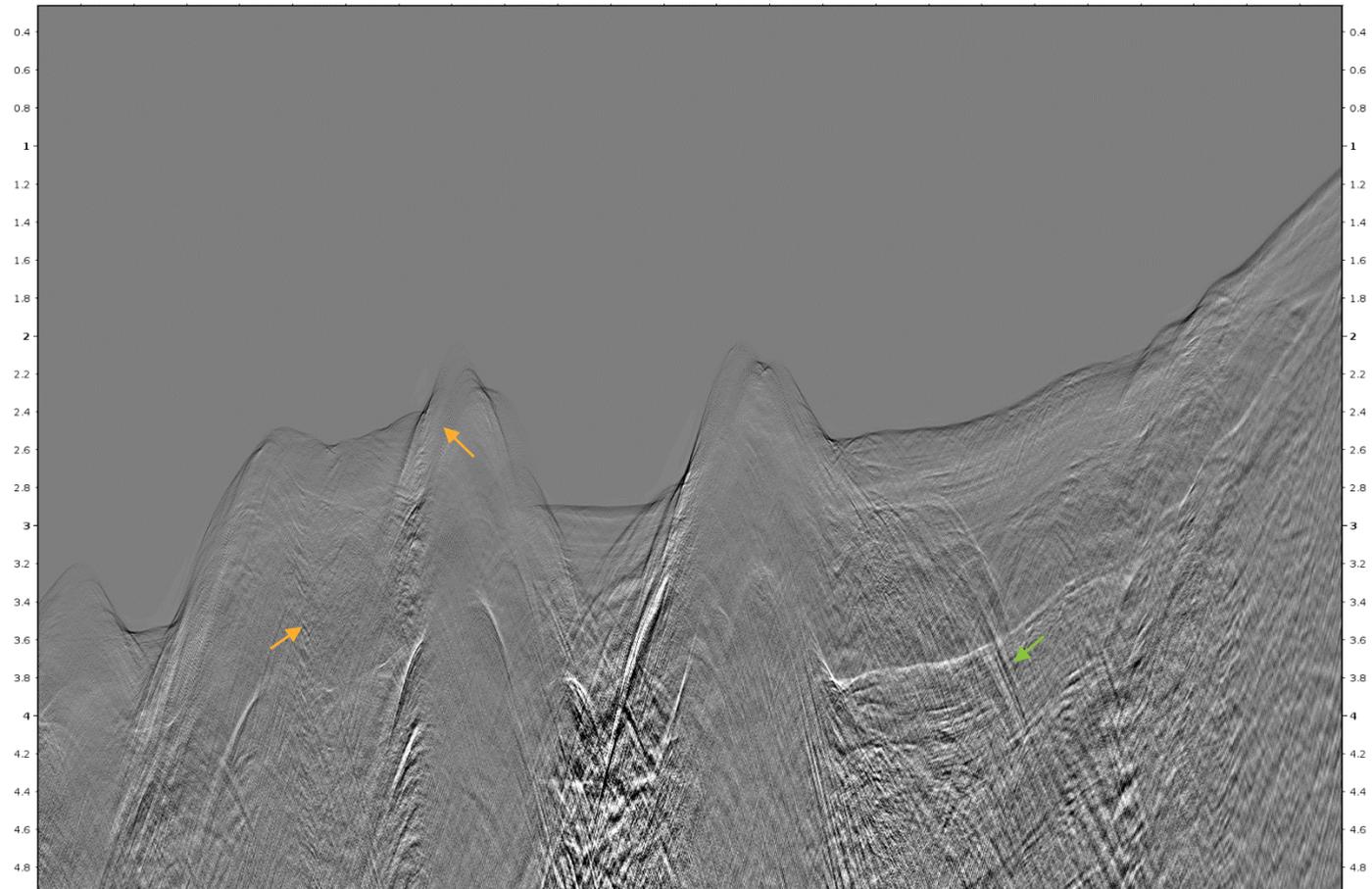




Zoom in Stack – SRME Model

LINESEQ 18 / CROSSLINE

5096 5315 5534 5753 5972 6191 6410 6629 6848 7067 7286 7505 7724 7943 8162 8381 8600 8819 9038 9257 9476 9695 9914 10133

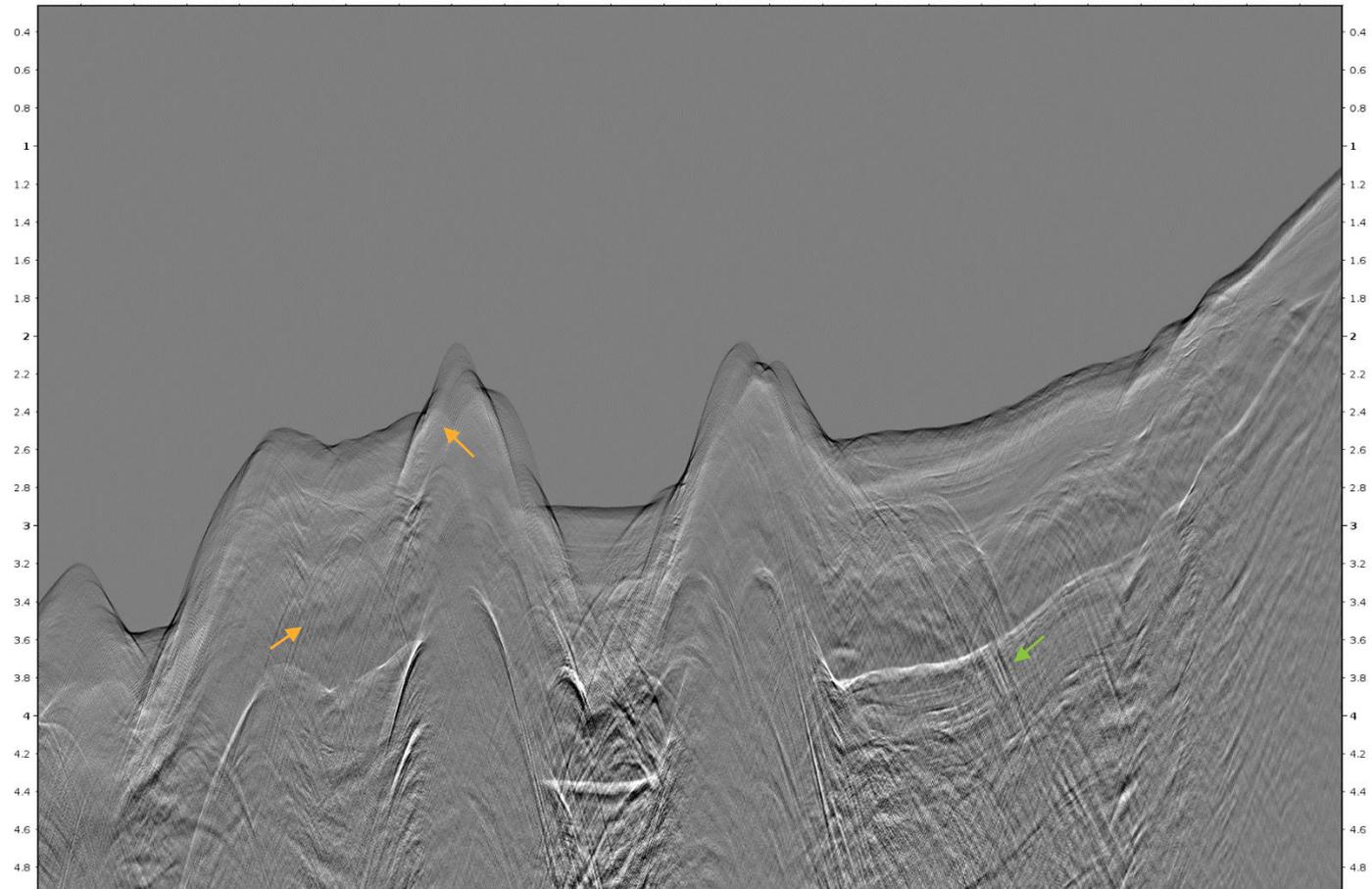




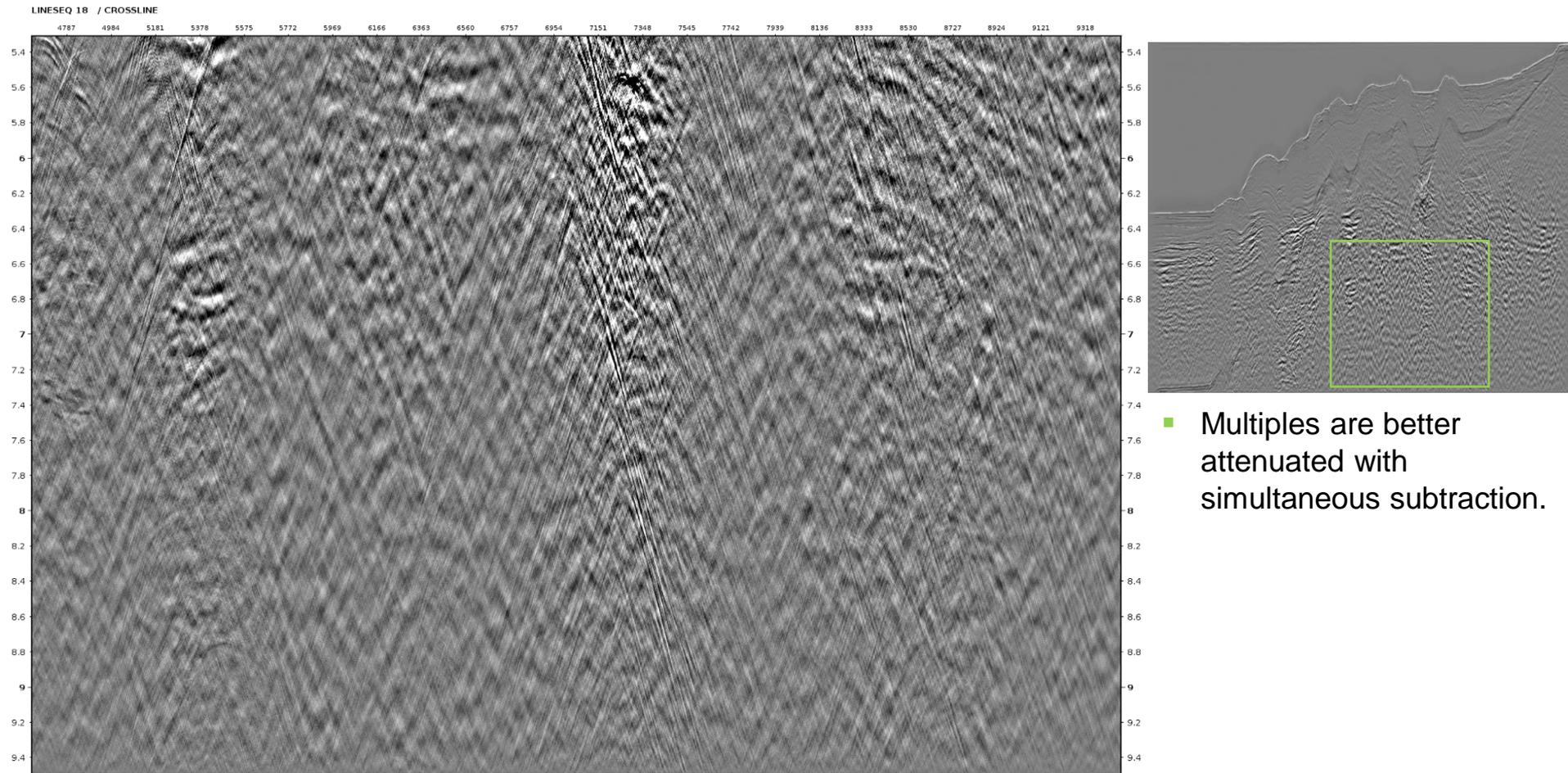
Zoom in Stack – MWD Model

LINESEQ 18 / CROSSLINE

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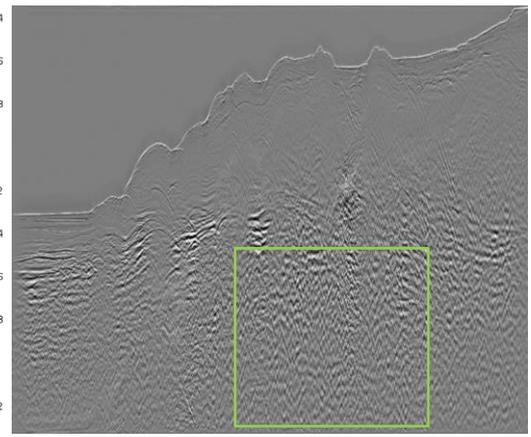
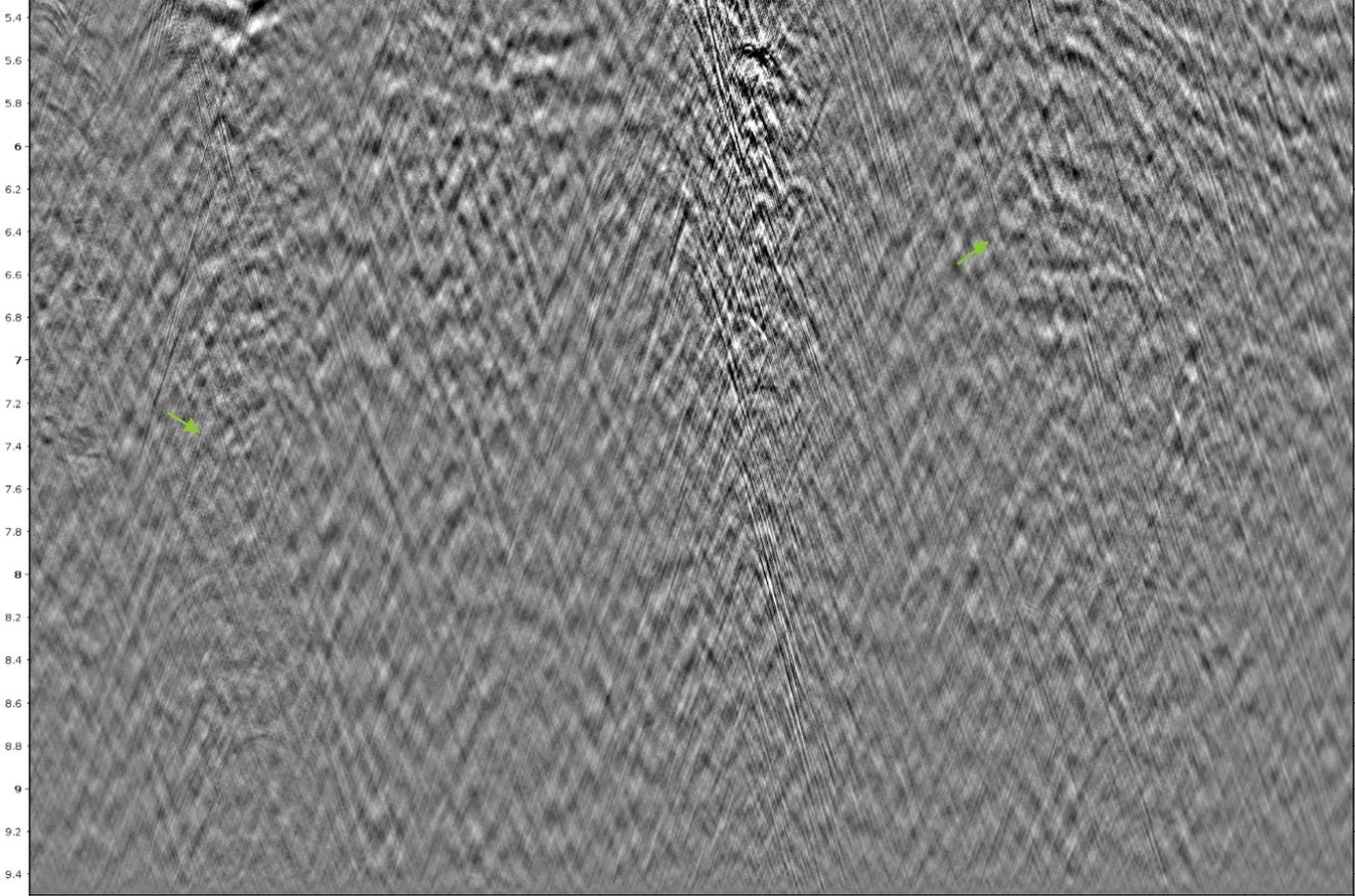
Zoom in Stack before Subtraction



Zoom in Stack after SRME Subtraction

LINESEQ 18 / CROSSLINE

4787 4984 5181 5378 5575 5772 5969 6166 6363 6560 6757 6954 7151 7348 7545 7742 7939 8136 8333 8530 8727 8924 9121 9318



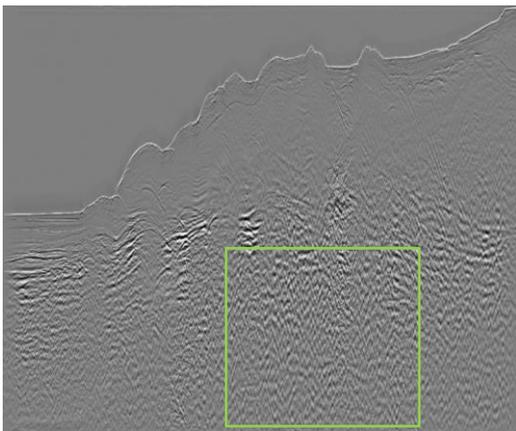
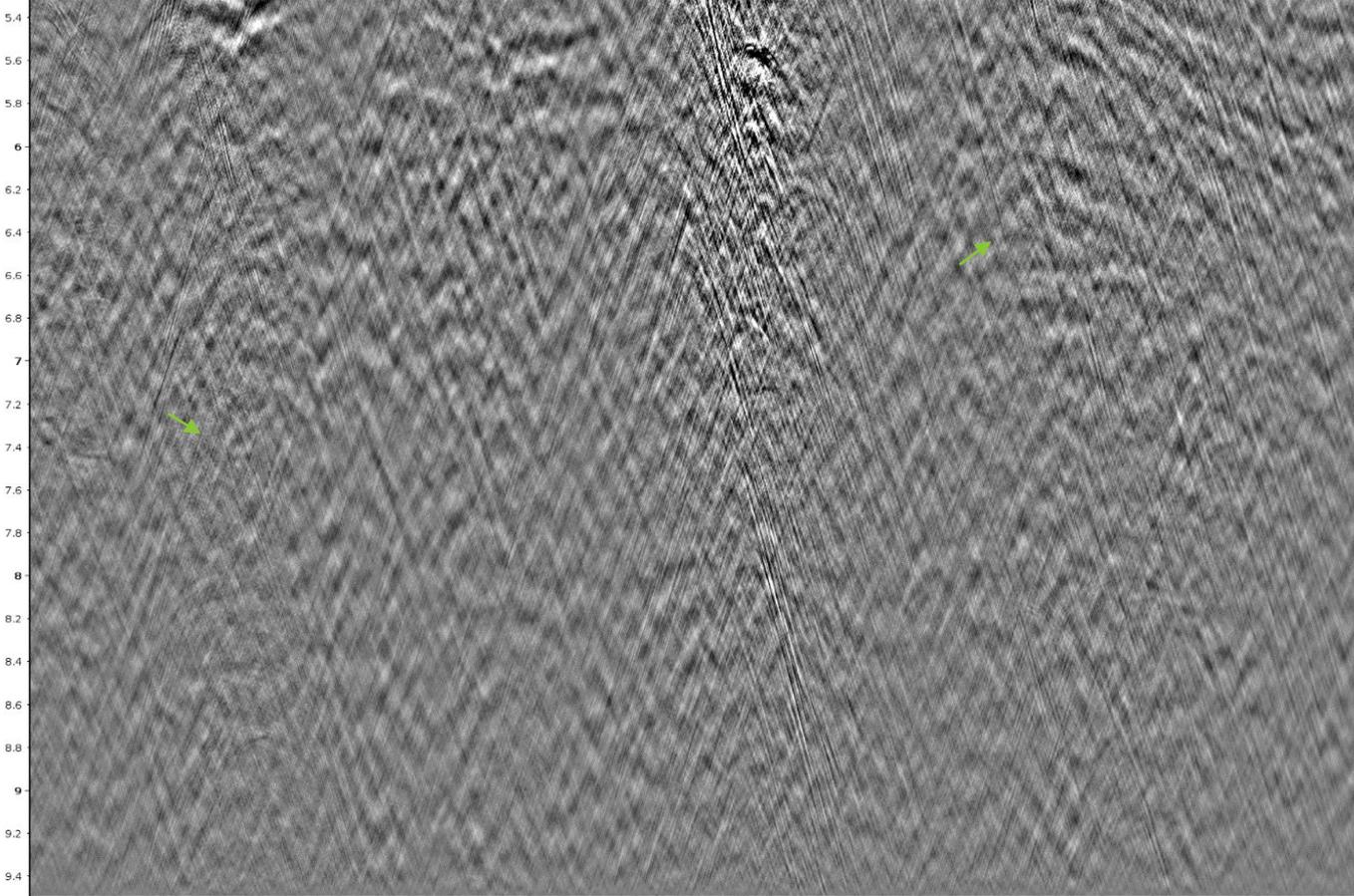
- Multiples are better attenuated with simultaneous subtraction.



Zoom in Stack after SRME & MWD Subtraction

LINESEQ 18 / CROSSLINE

4787 4984 5181 5378 5575 5772 5969 6166 6363 6560 6757 6954 7151 7348 7545 7742 7939 8136 8333 8530 8727 8924 9121 9318



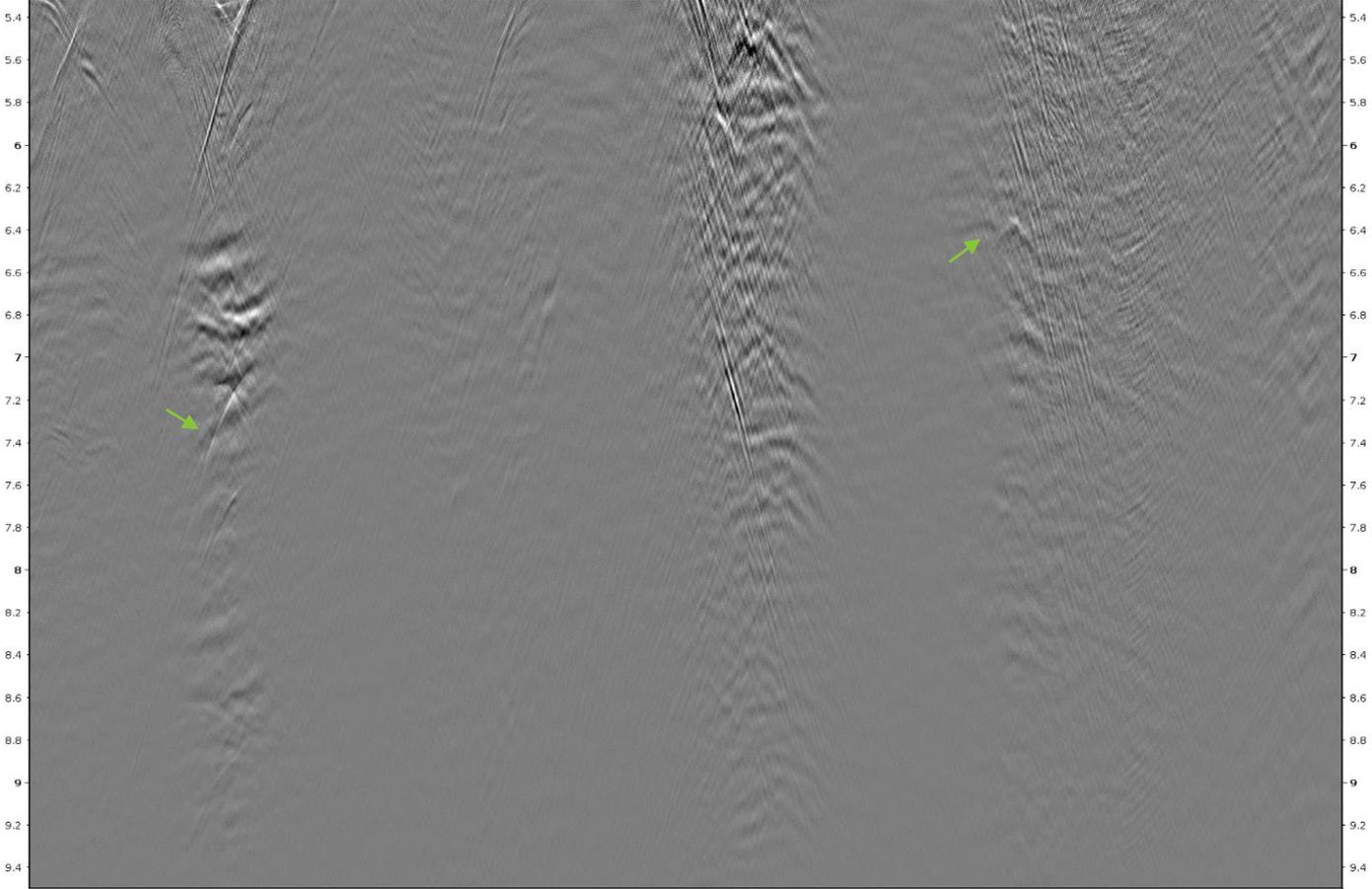
- Multiples are better attenuated with simultaneous subtraction.



Difference before – after SRME Subtraction

LINESEQ 18 / CROSSLINE

4787 4984 5181 5378 5575 5772 5969 6166 6363 6560 6757 6954 7151 7348 7545 7742 7939 8136 8333 8530 8727 8924 9121 9318

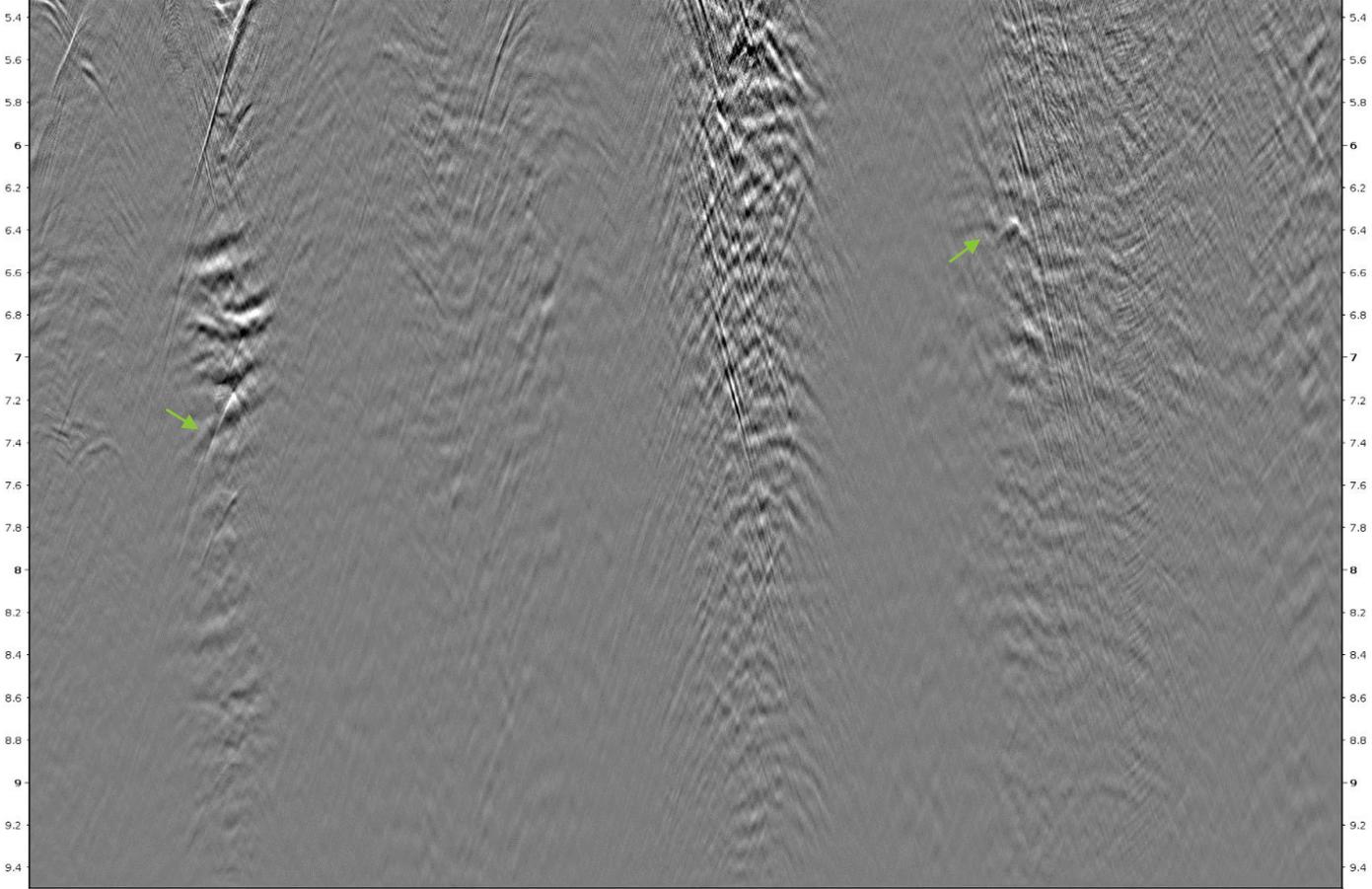




Difference before – after SRME & MWD Subtraction

LINESEQ 18 / CROSSLINE

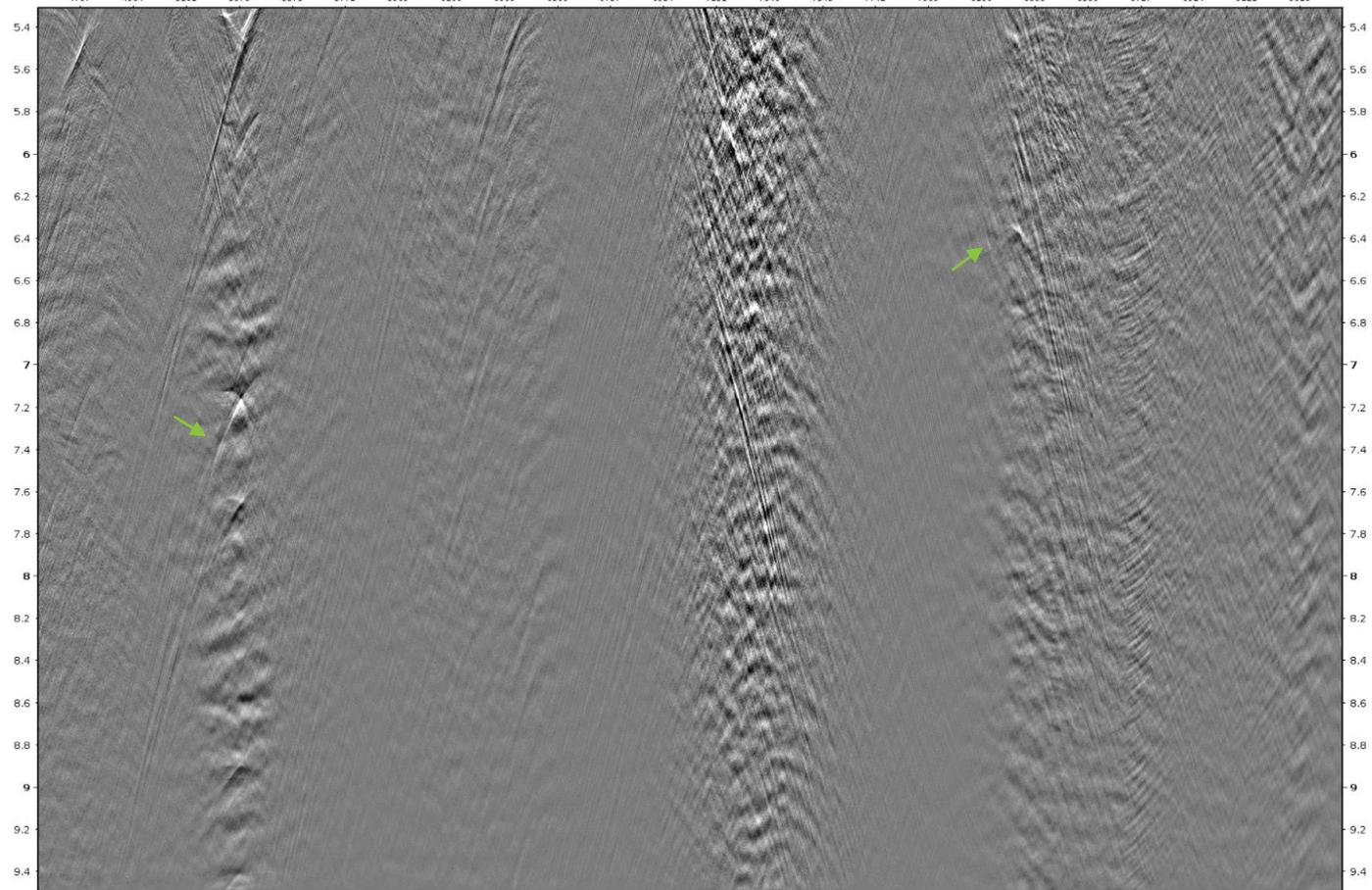
4787 4984 5181 5378 5575 5772 5969 6166 6363 6560 6757 6954 7151 7348 7545 7742 7939 8136 8333 8530 8727 8924 9121 9318



Zoom in Stack – SRME Model

LINESEQ 18 / CROSSLINE

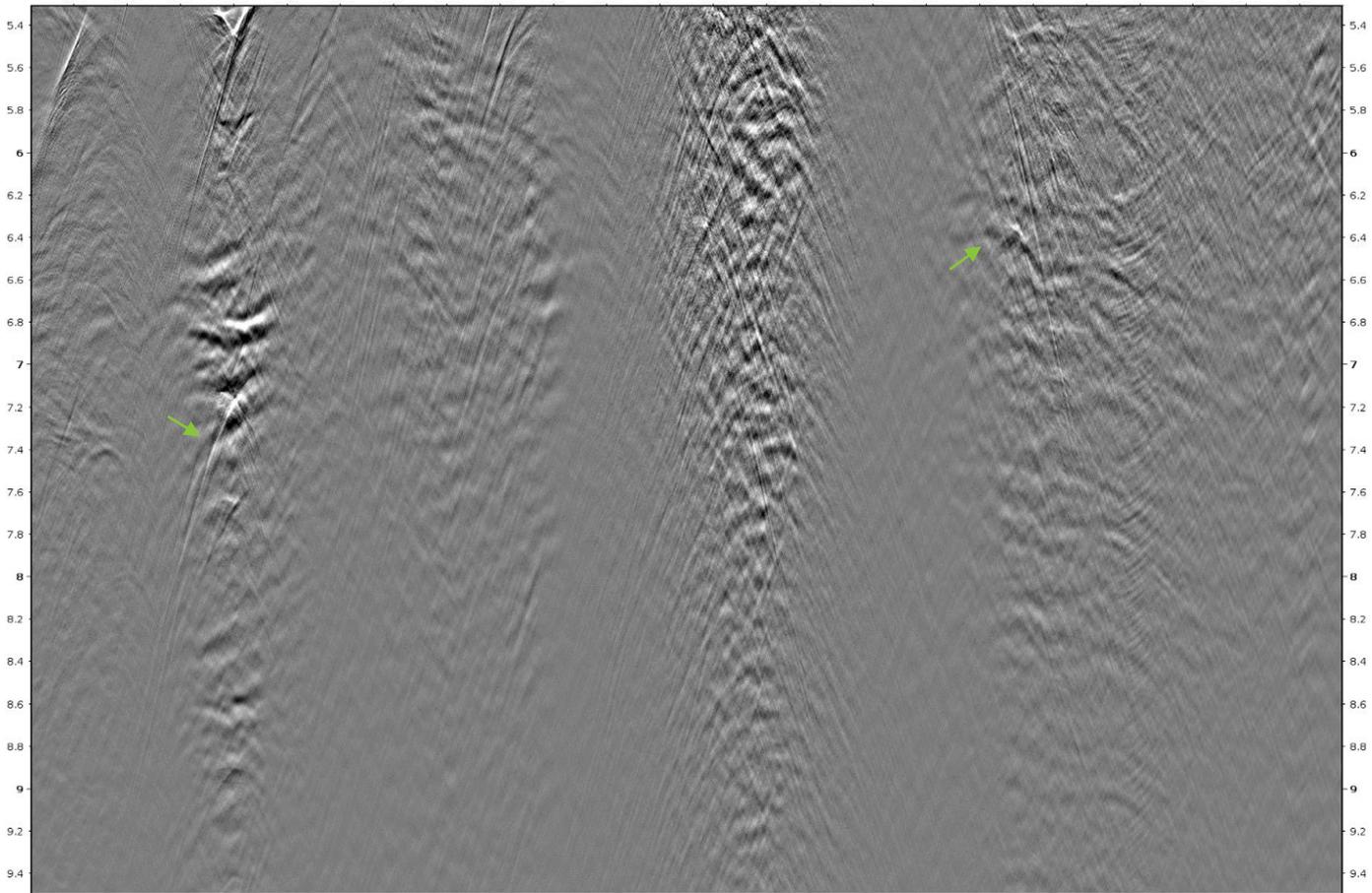
4787 4984 5181 5378 5575 5772 5969 6166 6363 6560 6757 6954 7151 7348 7545 7742 7939 8136 8333 8530 8727 8924 9121 9318



Zoom in Stack – MWD Model

LINESEQ 18 / CROSSLINE

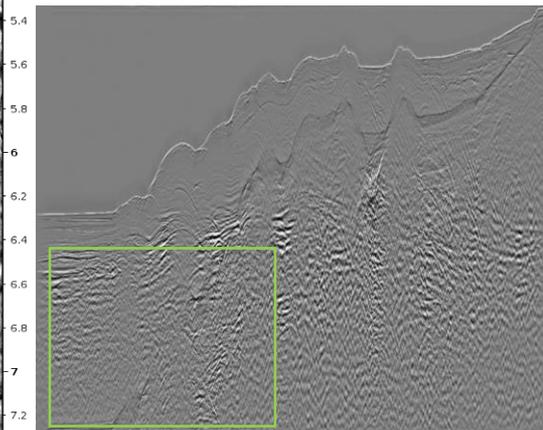
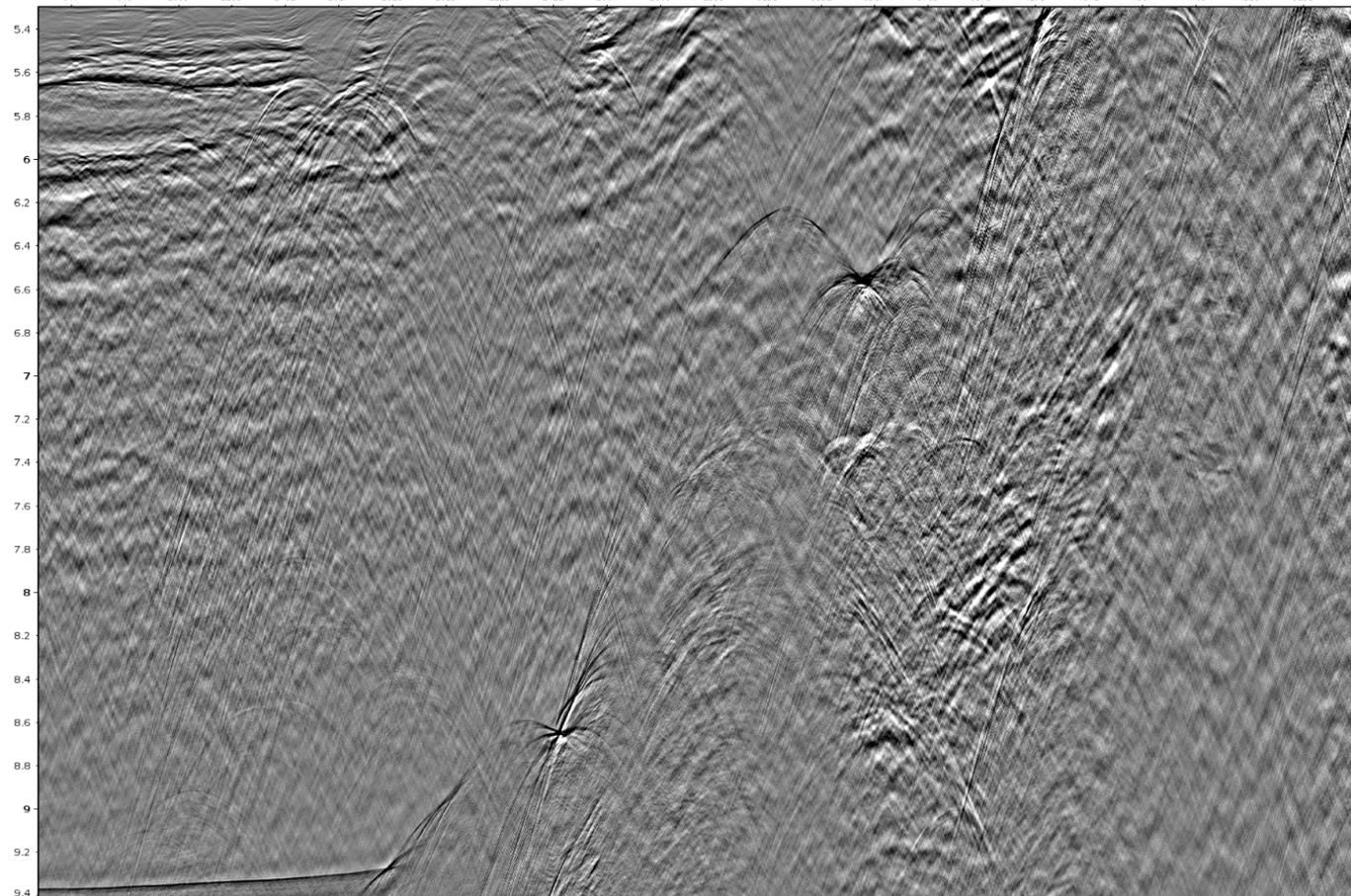
4787 4984 5181 5378 5575 5772 5969 6166 6363 6560 6757 6954 7151 7348 7545 7742 7939 8136 8333 8530 8727 8924 9121 9318



Zoom in Stack before Subtraction

LINESEQ 18 / CROSSLINE

647 843 1039 1235 1431 1627 1823 2019 2215 2411 2607 2803 2999 3195 3391 3587 3783 3979 4175 4371 4567 4763 4959 5155

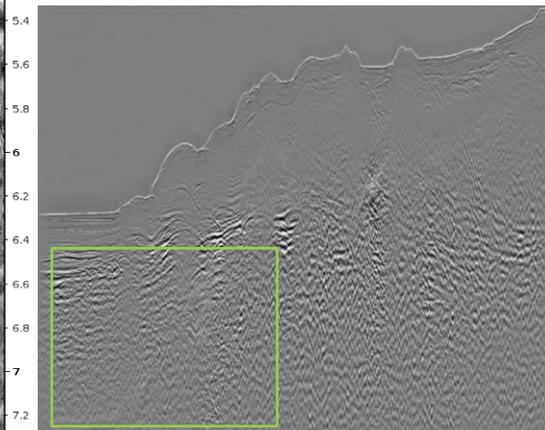
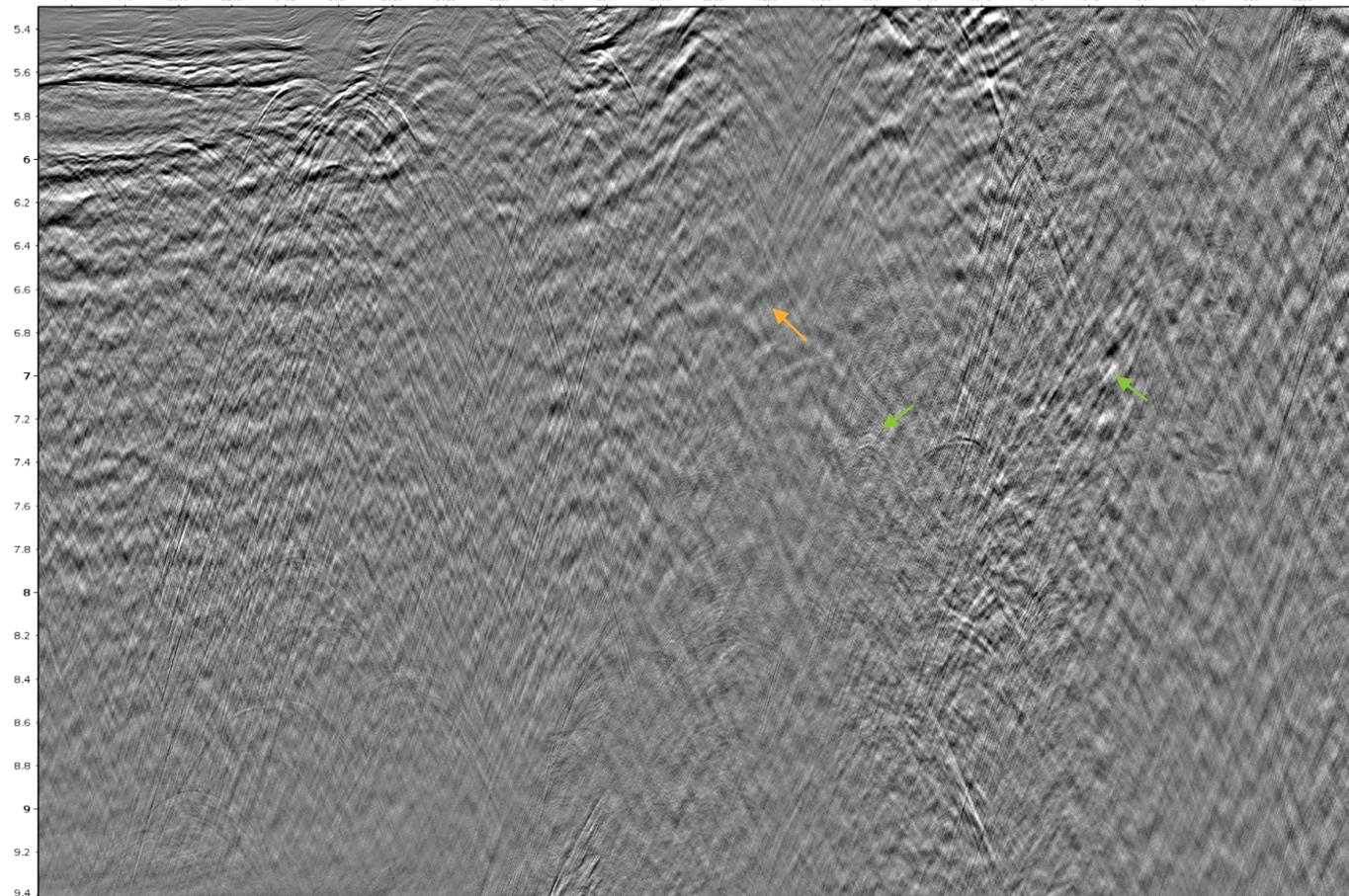


- Multiples are better attenuated with simultaneous subtraction.
- Primaries are protected by simultaneous subtraction flow.

Zoom in Stack after SRME Subtraction

LINESEQ 18 / CROSSLINE

647 843 1039 1235 1431 1627 1823 2019 2215 2411 2607 2803 2999 3195 3391 3587 3783 3979 4175 4371 4567 4763 4959 5155



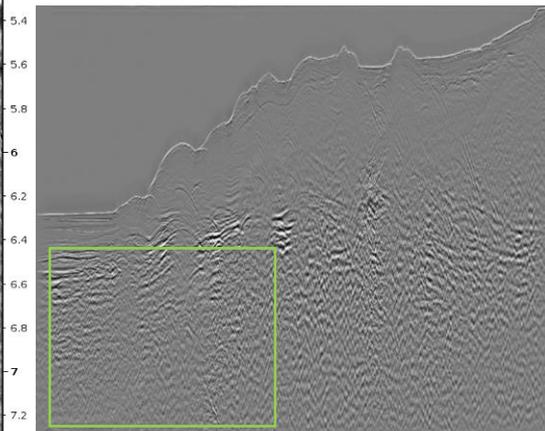
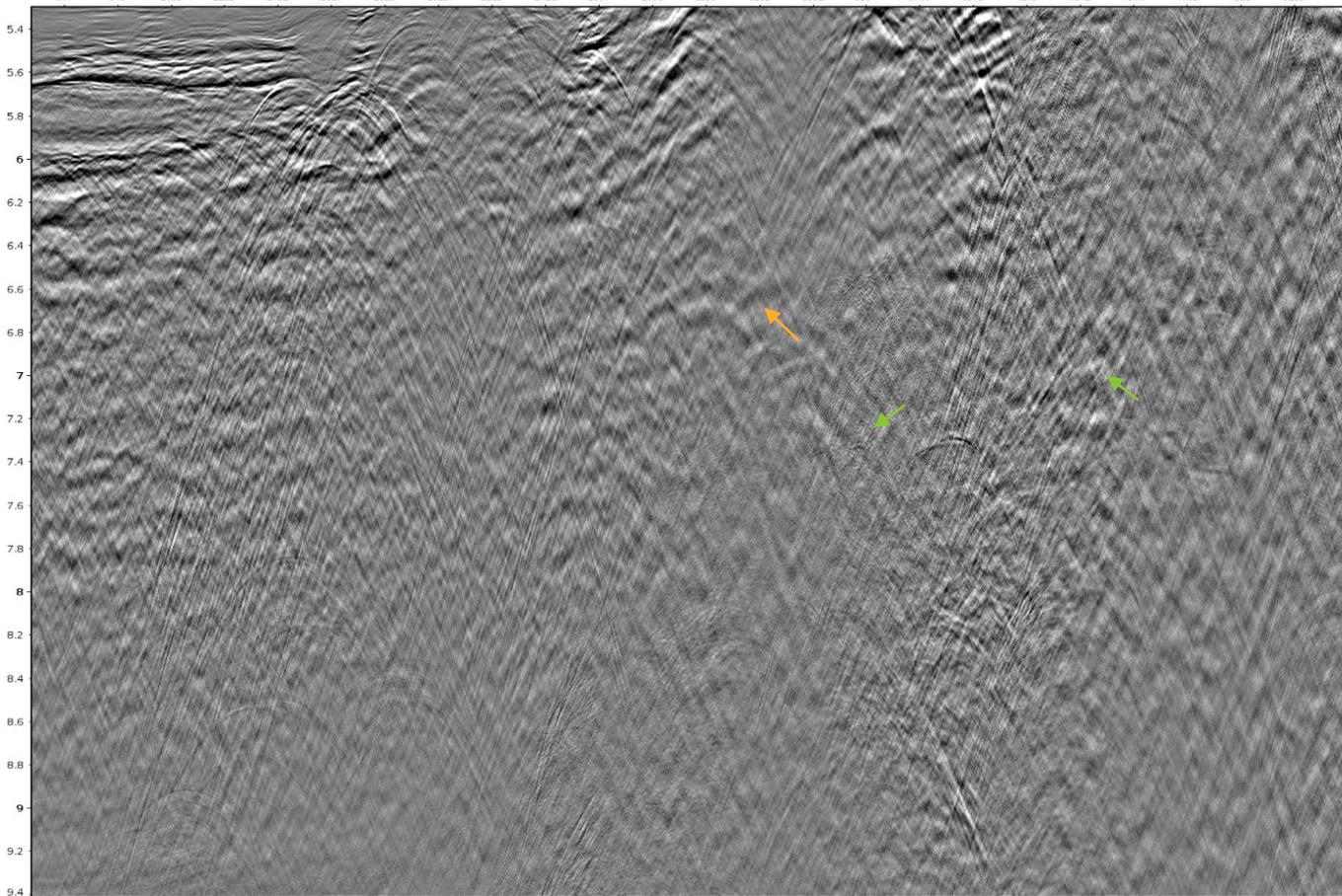
- Multiples are better attenuated with simultaneous subtraction.
- Primaries are protected by simultaneous subtraction flow.



Zoom in Stack after SRME & MWD Subtraction

LINESEQ 18 / CROSSLINE

647 843 1039 1235 1431 1627 1823 2019 2215 2411 2607 2803 2999 3195 3391 3587 3783 3979 4175 4371 4567 4763 4959 5155

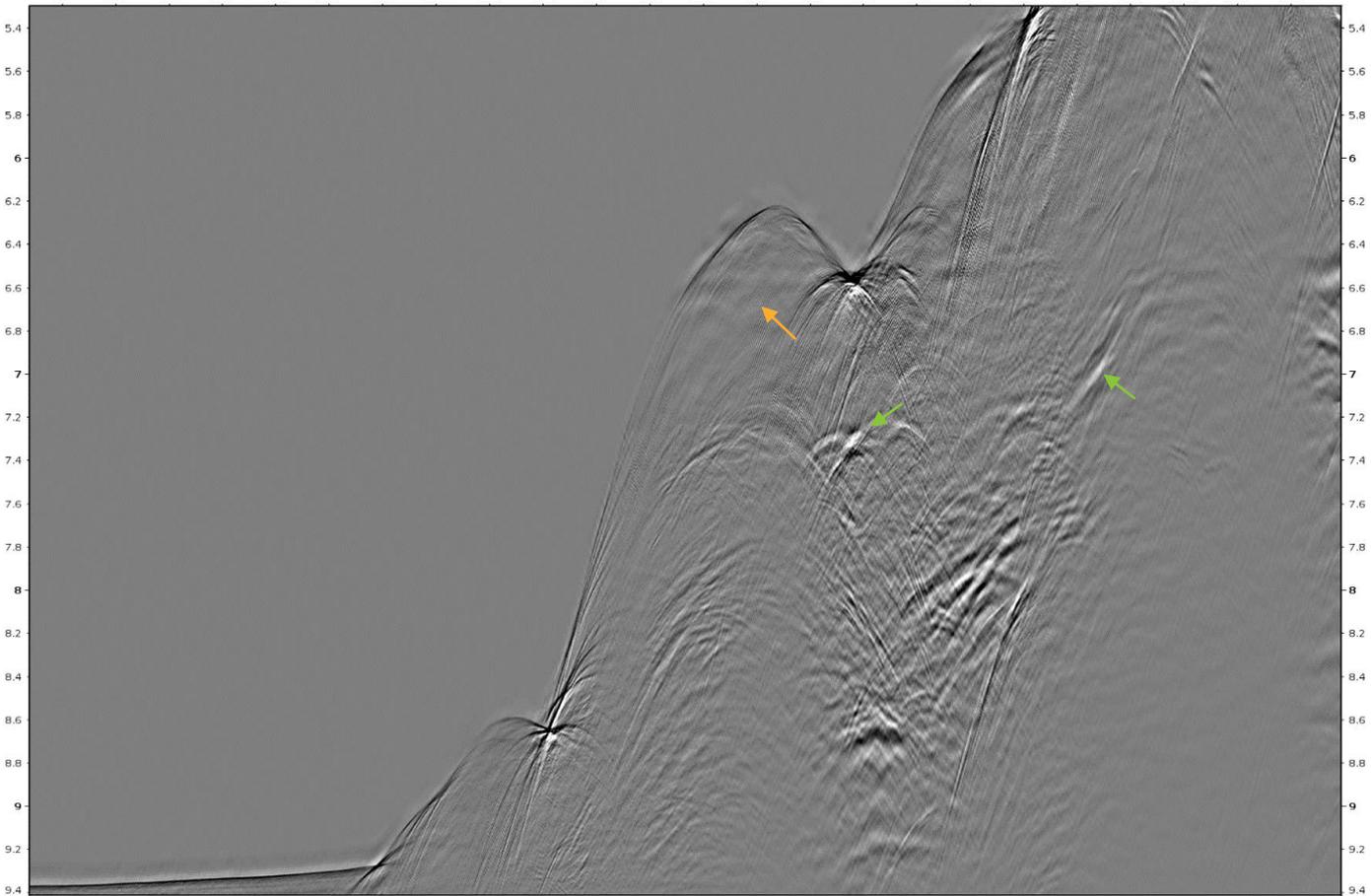


- Multiples are better attenuated with simultaneous subtraction.
- Primaries are protected by simultaneous subtraction flow.

Difference before – after SRME Subtraction

LINESEQ 18 / CROSSLINE

647 843 1039 1235 1431 1627 1823 2019 2215 2411 2607 2803 2999 3195 3391 3587 3783 3979 4175 4371 4567 4763 4959 5155

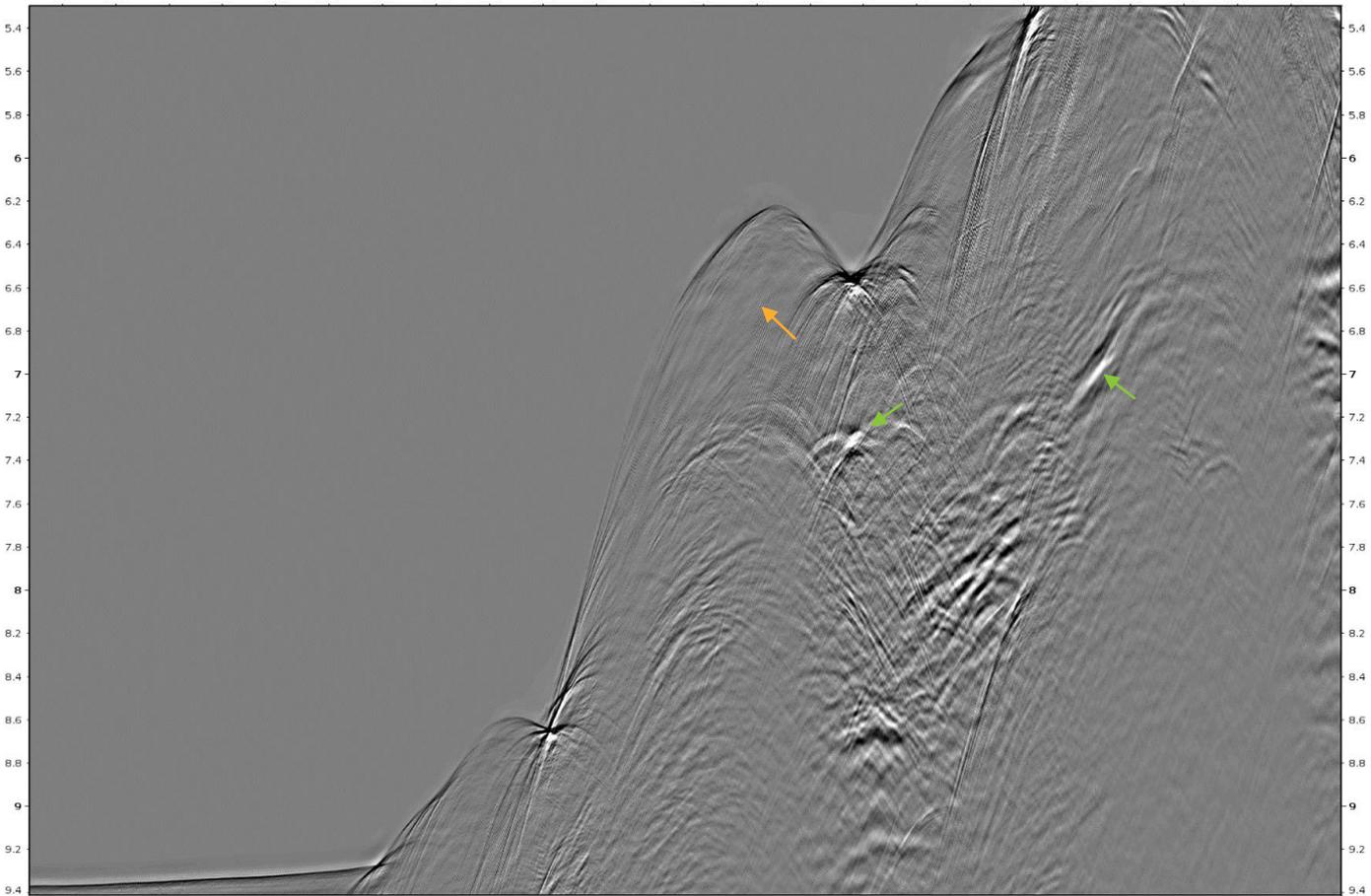




Difference before – after SRME & MWD Subtraction

LINESEQ 18 / CROSSLINE

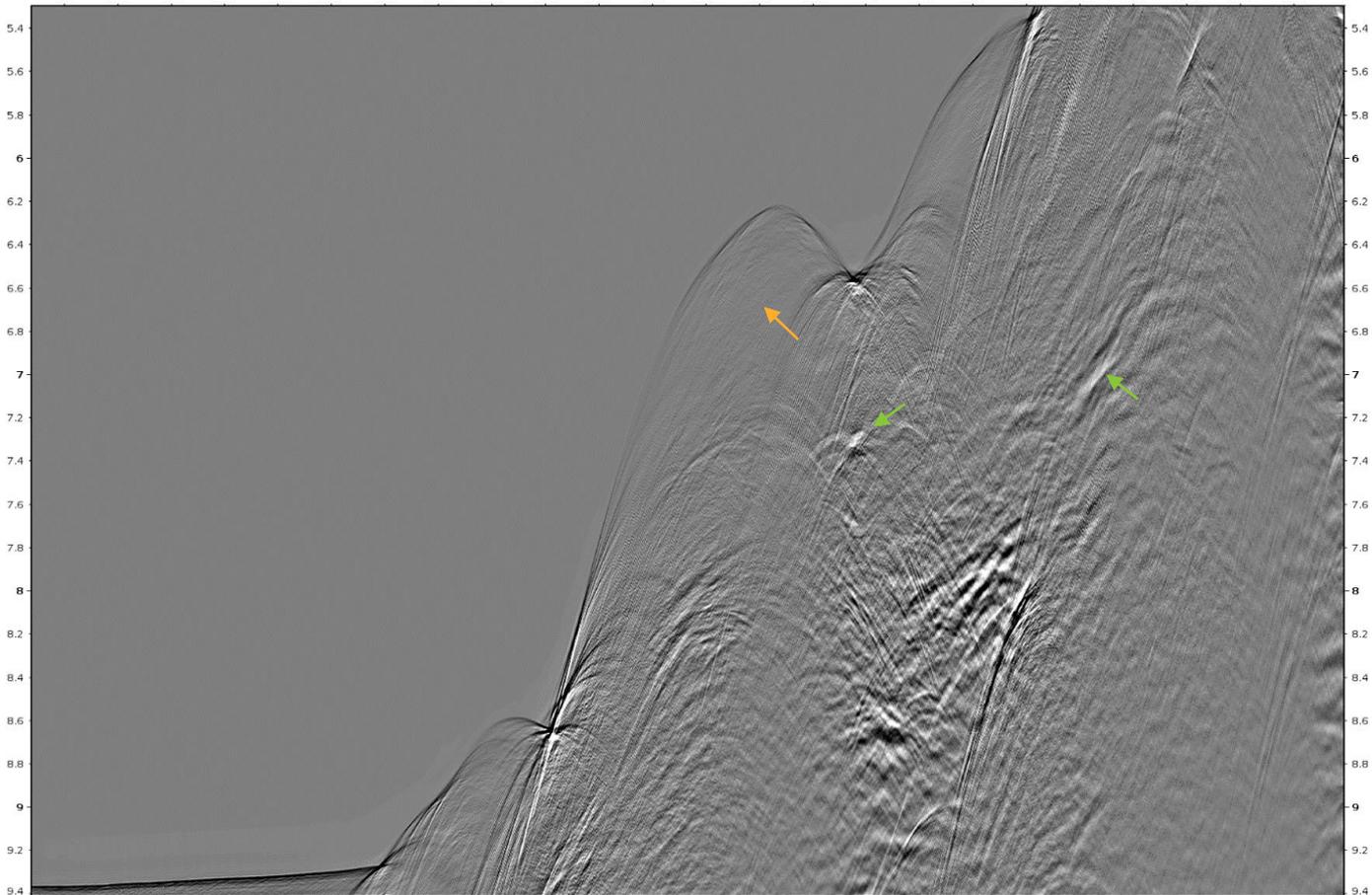
647 843 1039 1235 1431 1627 1823 2019 2215 2411 2607 2803 2999 3195 3391 3587 3783 3979 4175 4371 4567 4763 4959 5155



Zoom in Stack – SRME Model

LINESEQ 18 / CROSSLINE

647 843 1039 1235 1431 1627 1823 2019 2215 2411 2607 2803 2999 3195 3391 3587 3783 3979 4175 4371 4567 4763 4959 5155

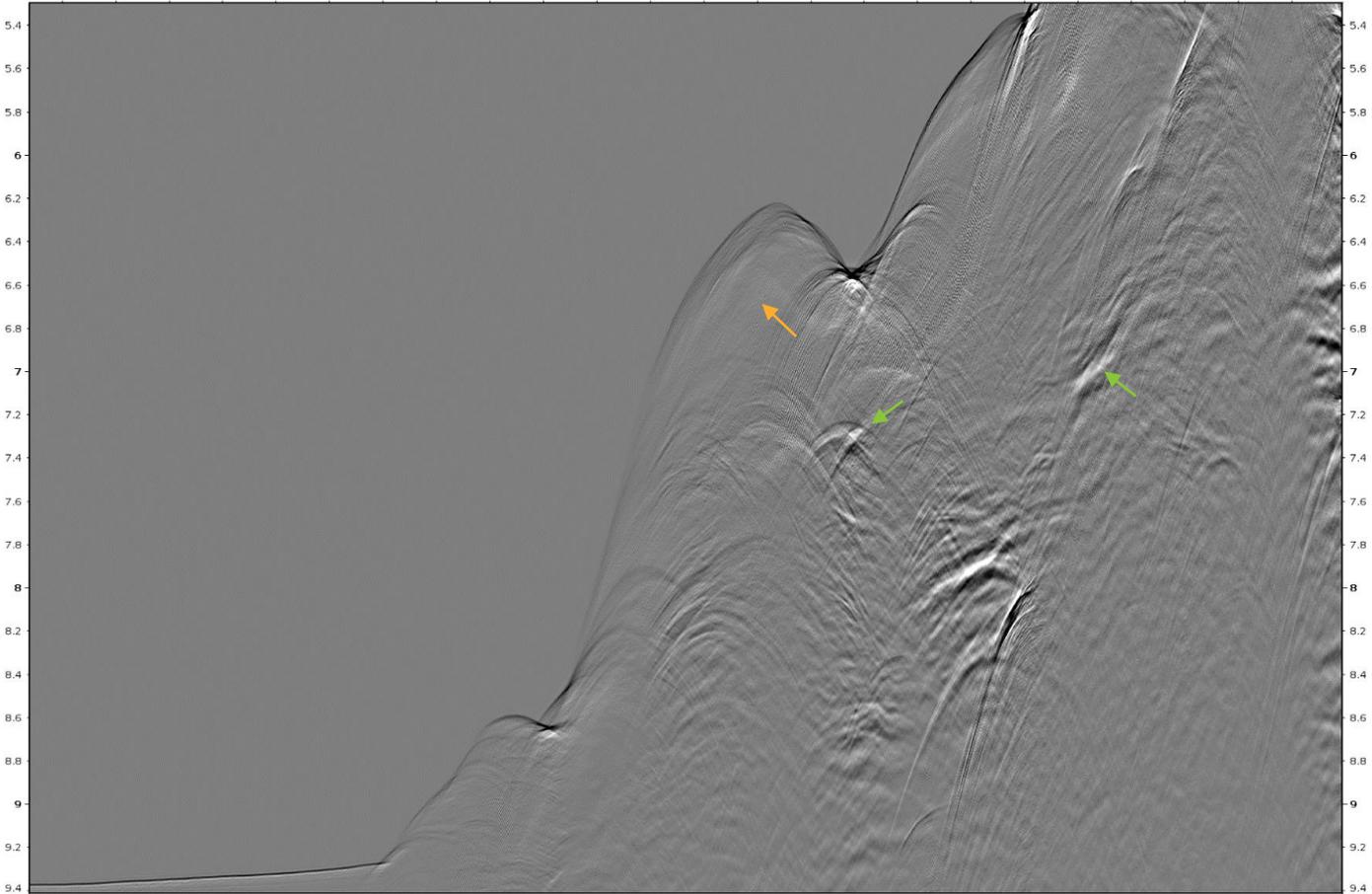




Zoom in Stack – MWD Model

LINESEQ 18 / CROSSLINE

647 843 1039 1235 1431 1627 1823 2019 2215 2411 2607 2803 2999 3195 3391 3587 3783 3979 4175 4371 4567 4763 4959 5155



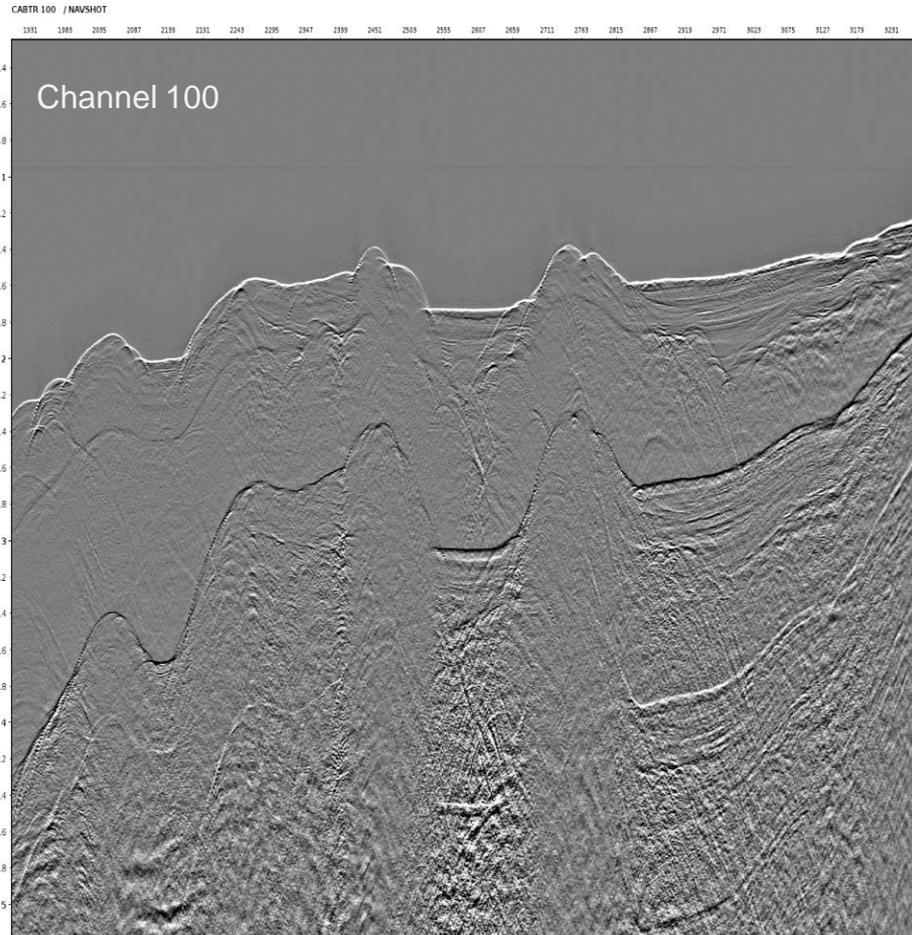
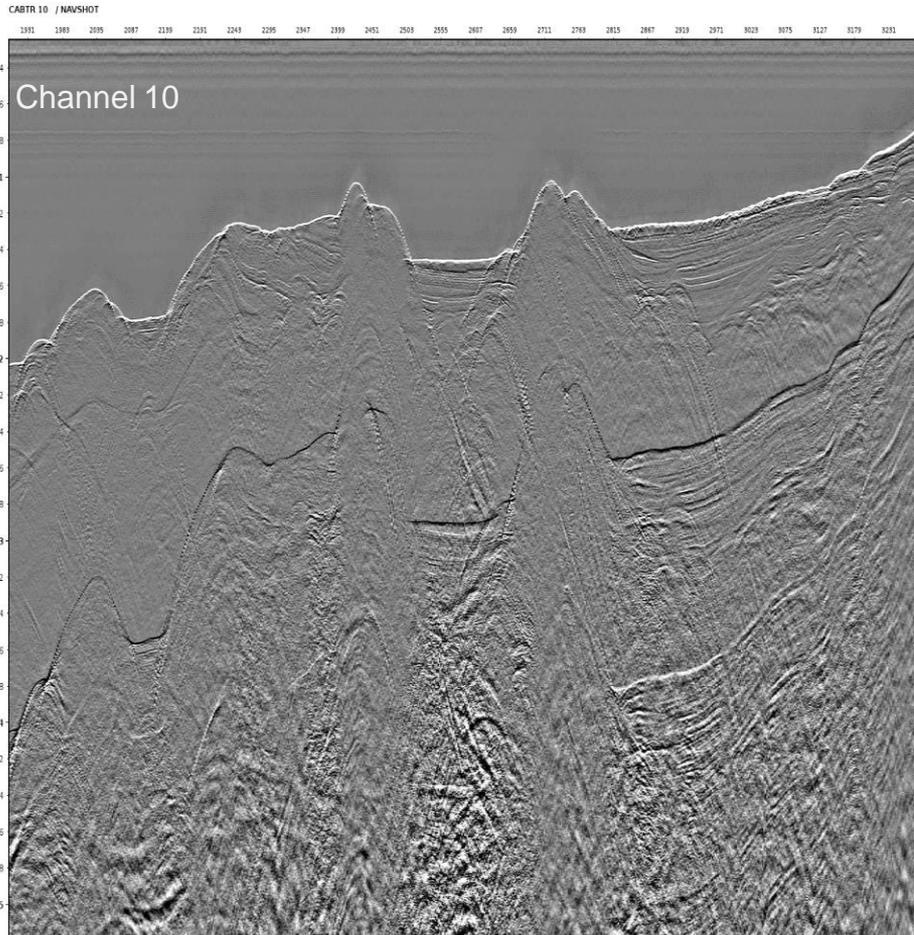
Seq 018

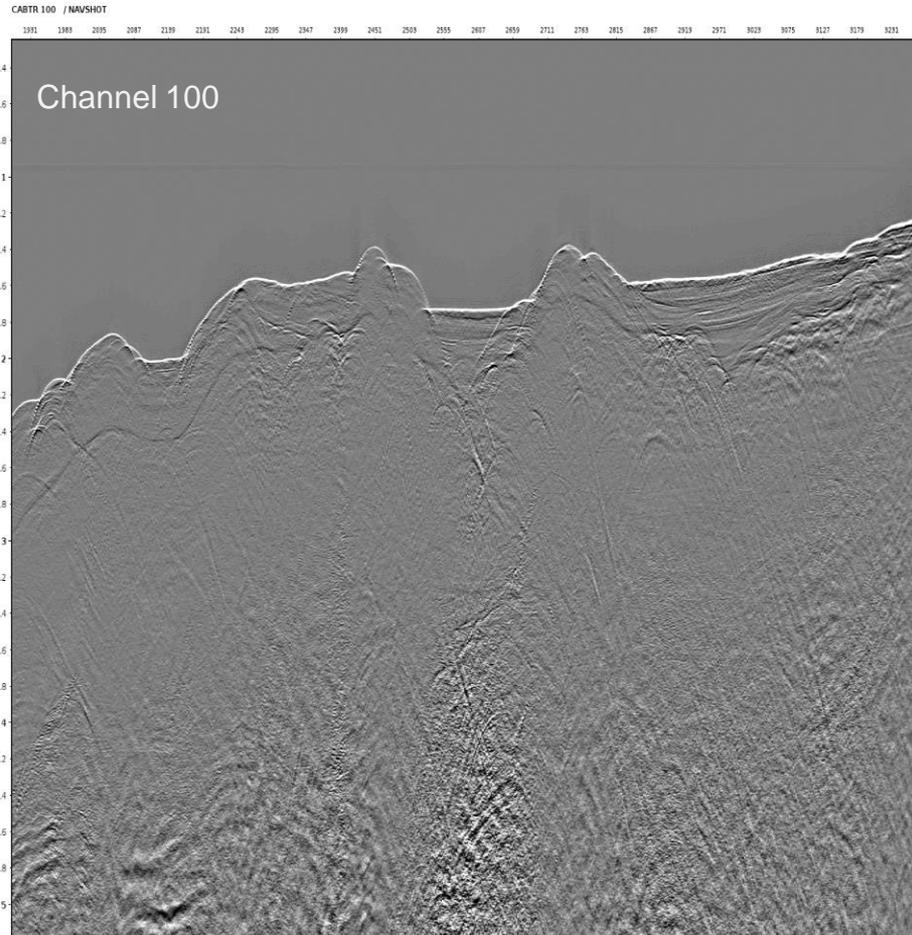
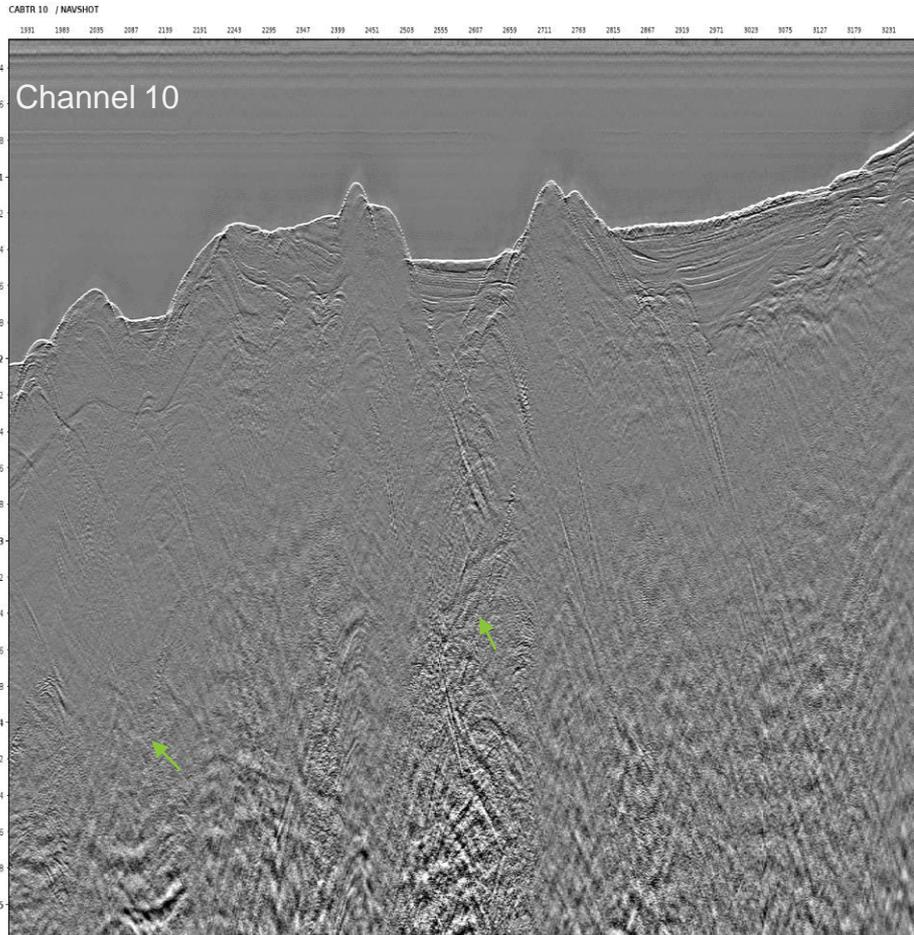
Stack

Common Channel

Shot Gathers

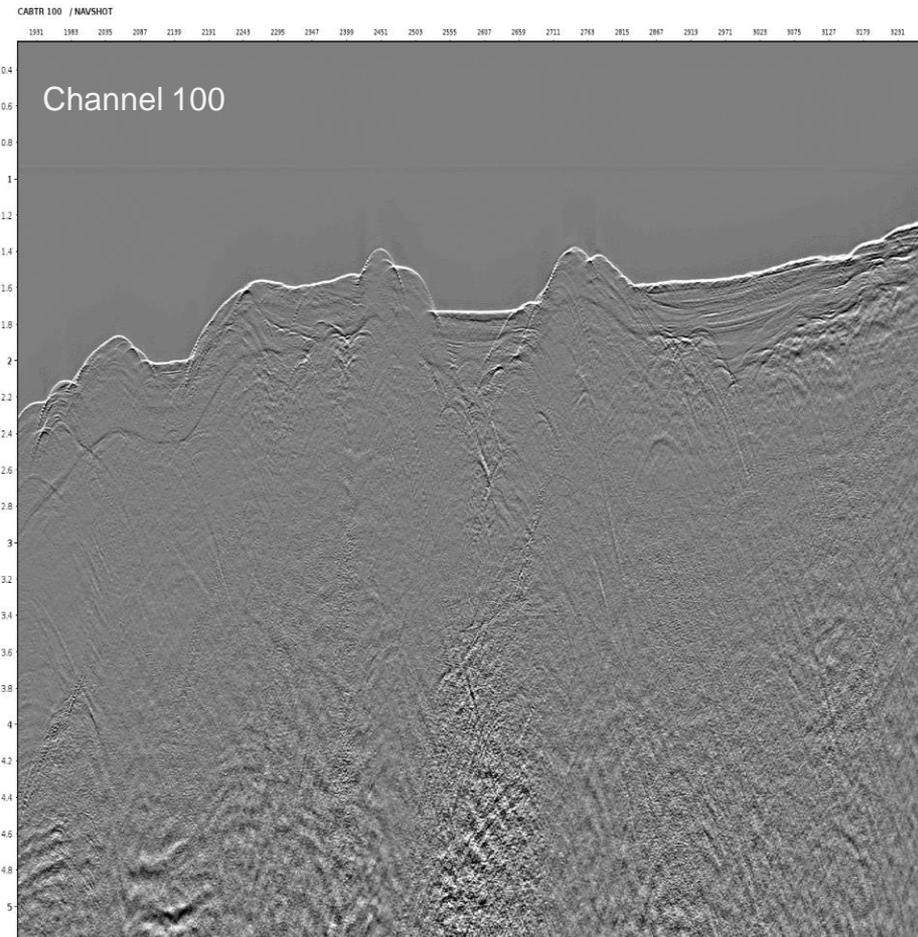
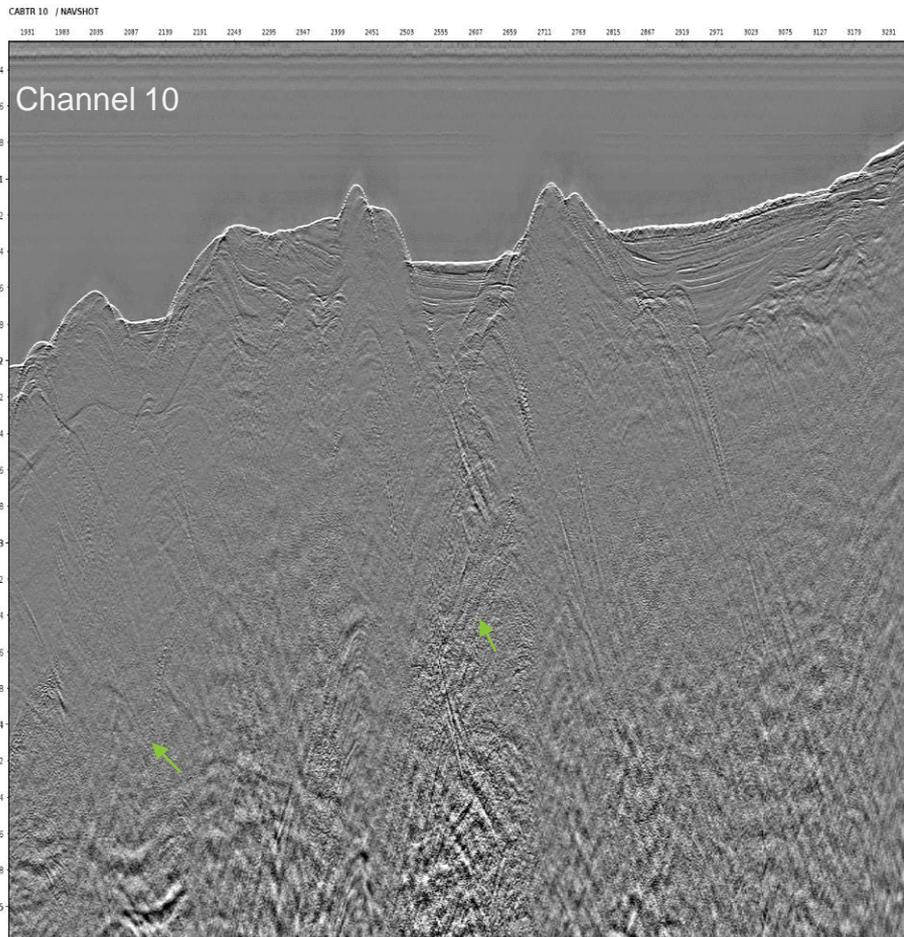






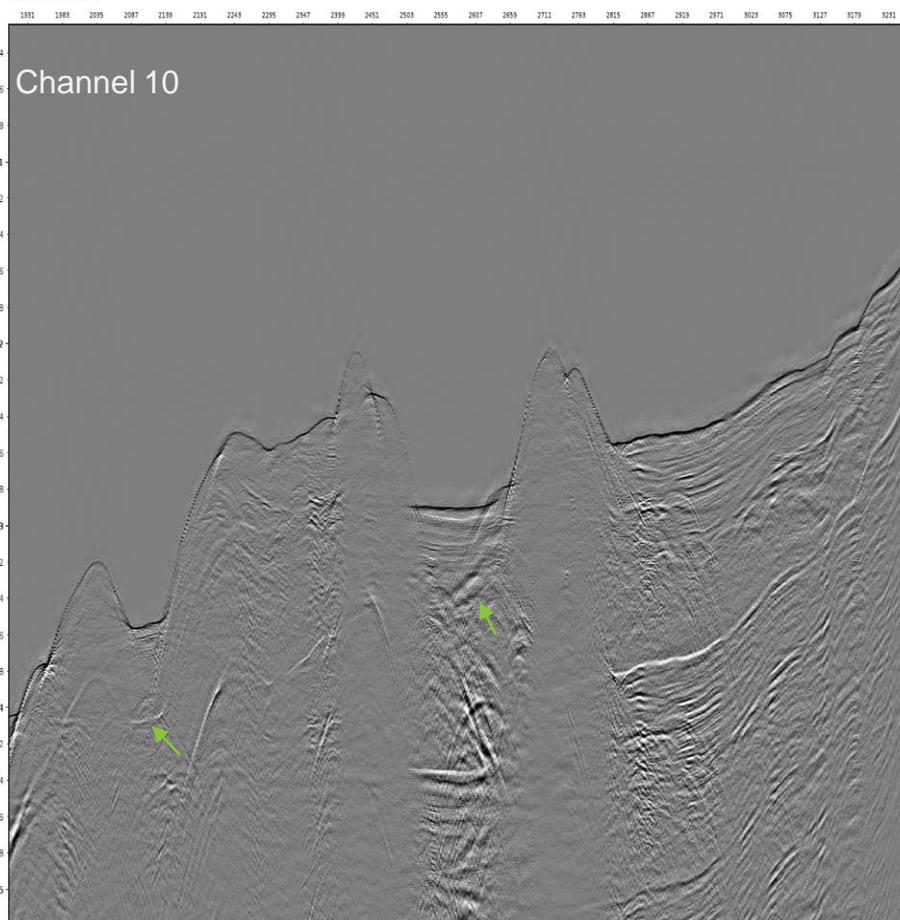


Common Channel **after** SRME & MWD Subtraction

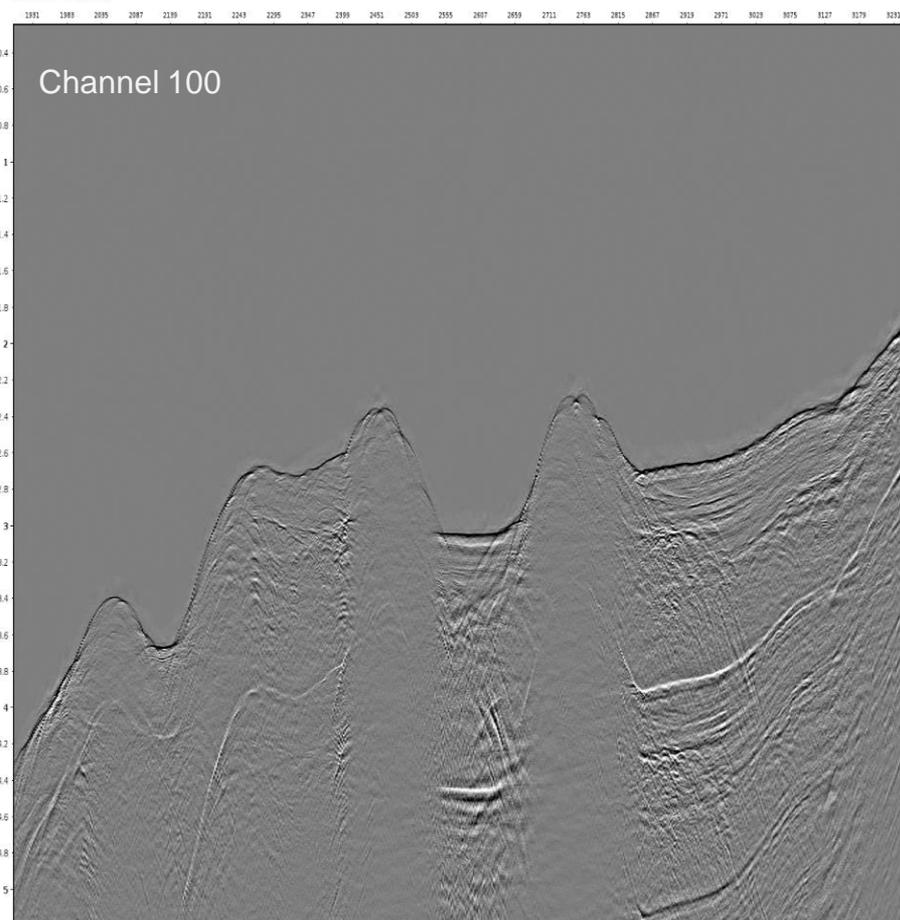


Difference before – after SRME Subtraction

CABTR 10 / NAVSHOT



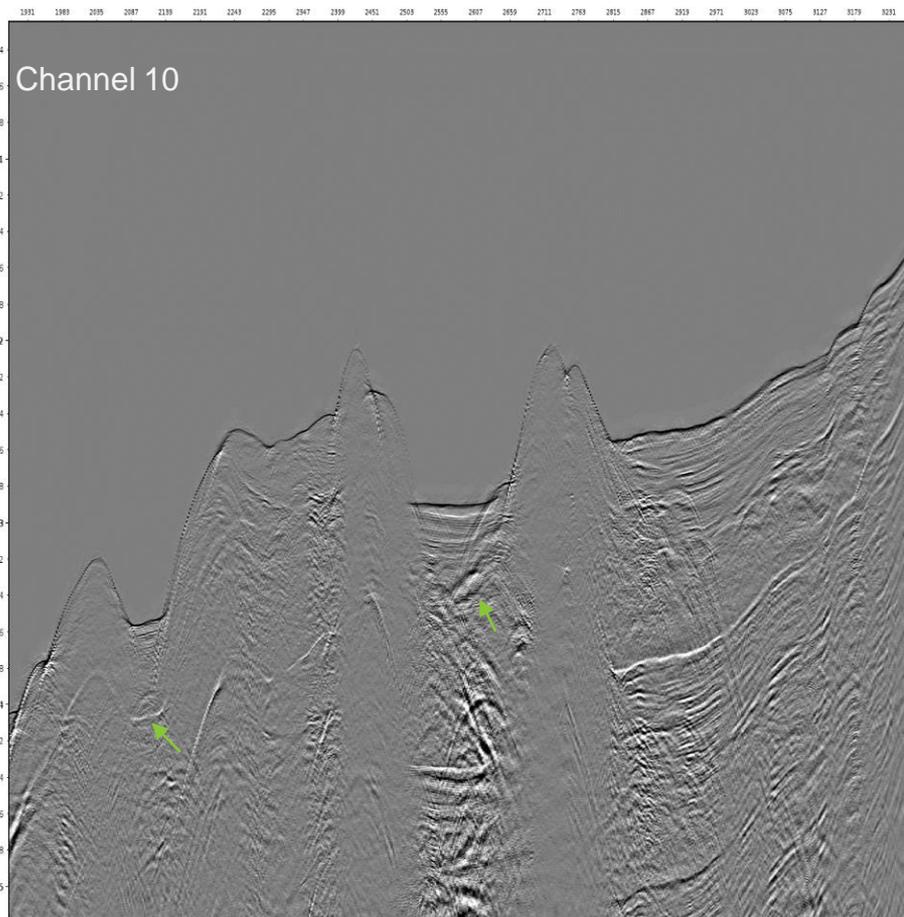
CABTR 100 / NAVSHOT



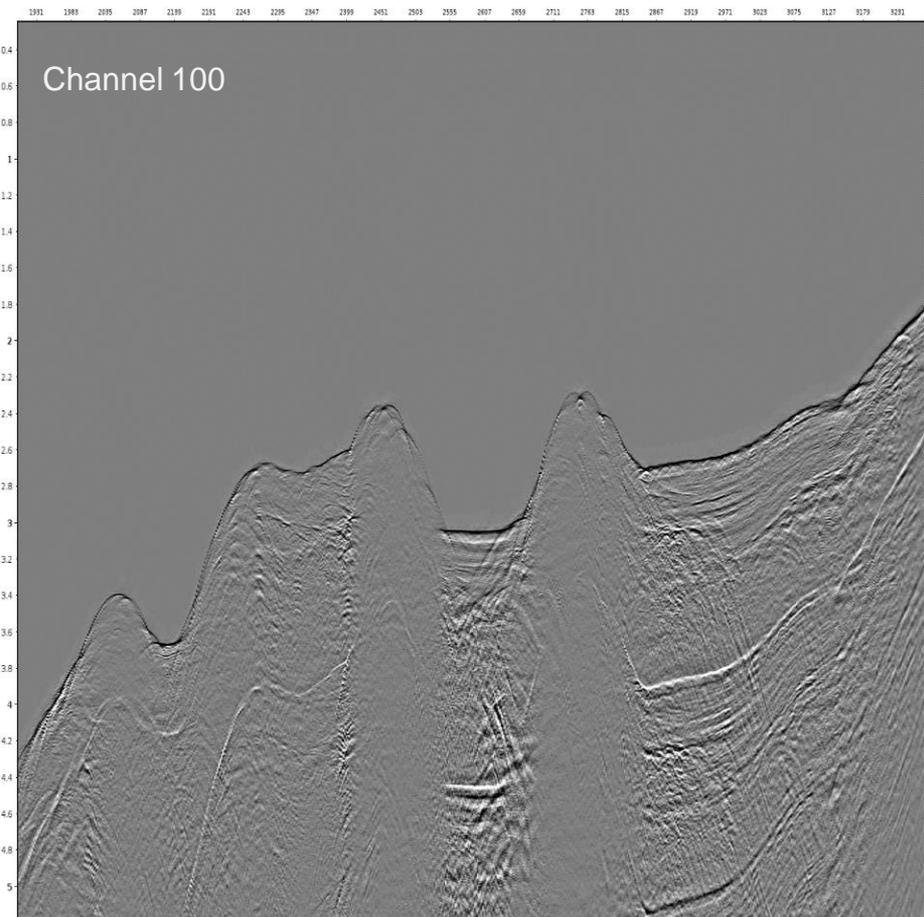


Difference before – after SRME & MWD Subtraction

CABTR 10 / NAVSHOT

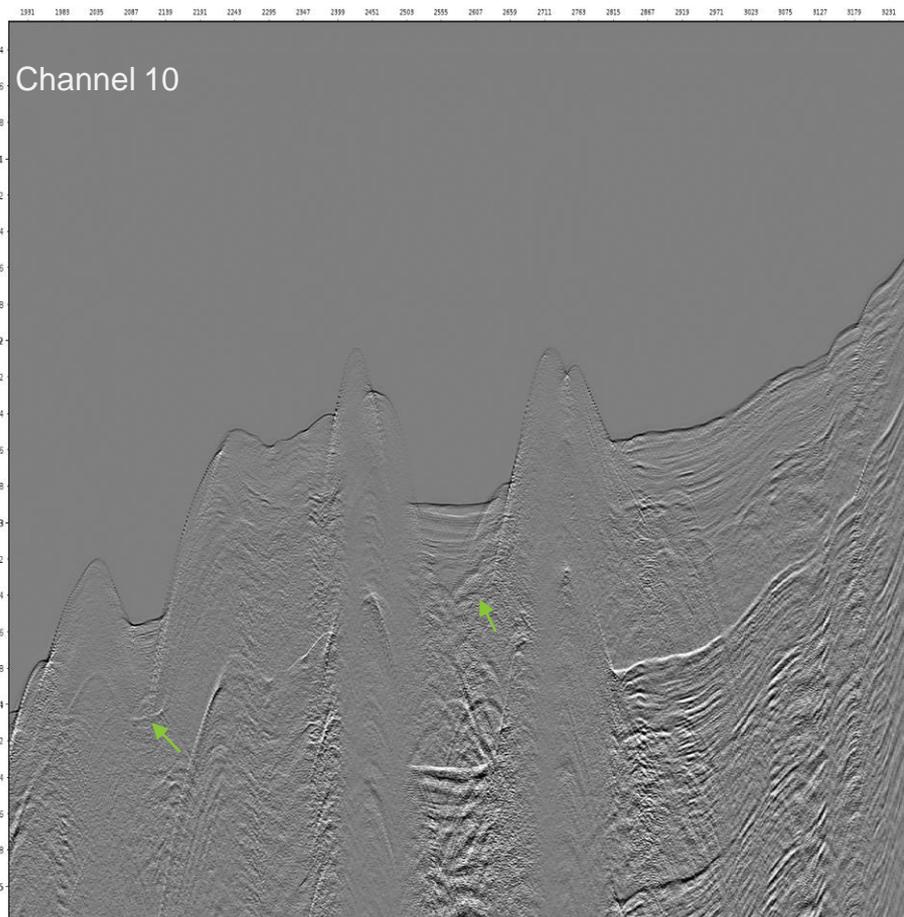


CABTR 100 / NAVSHOT

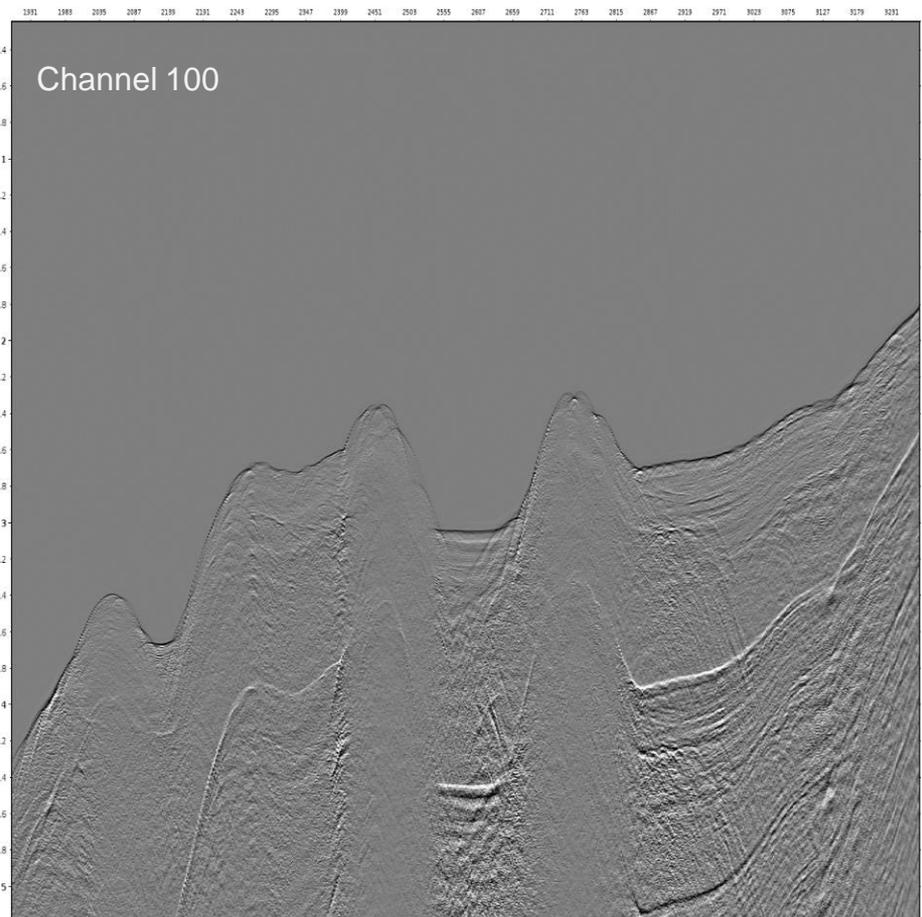




CABTR 10 / NAVSHOT

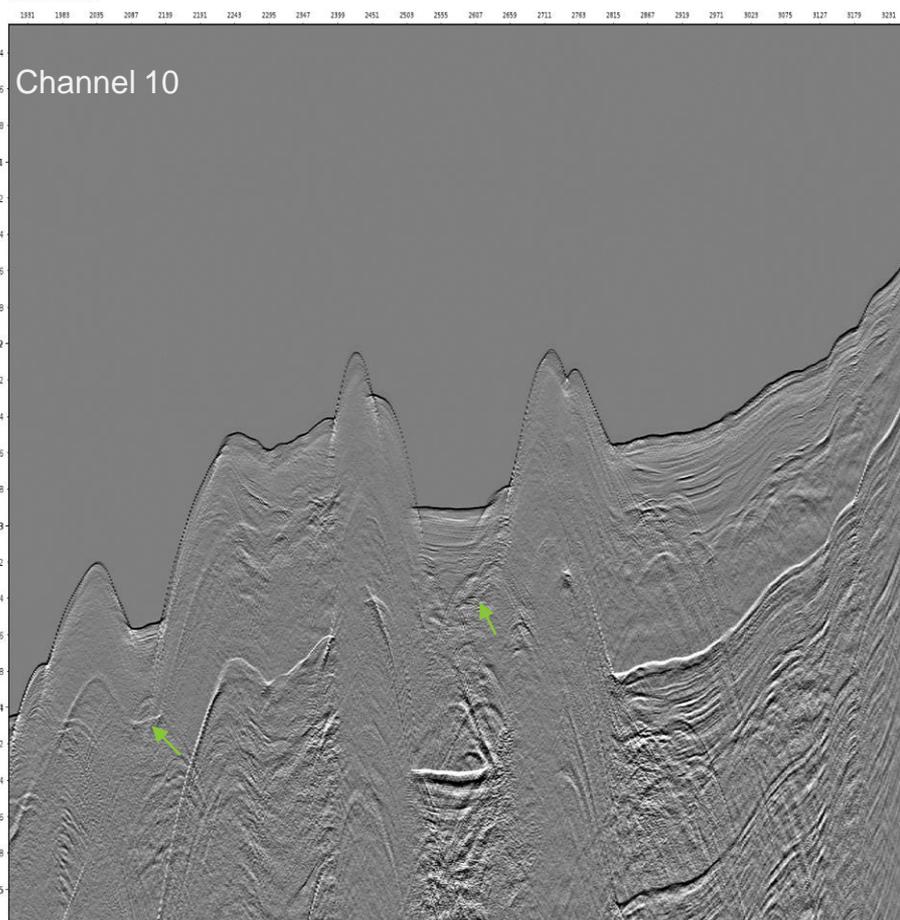


CABTR 100 / NAVSHOT

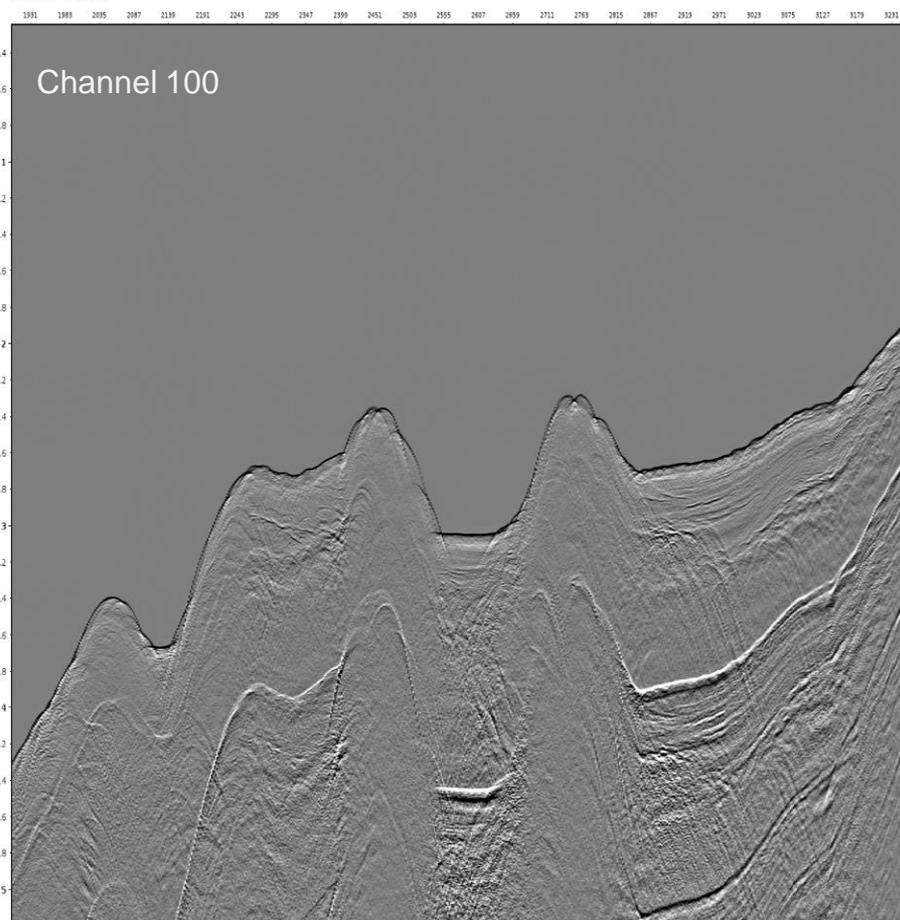


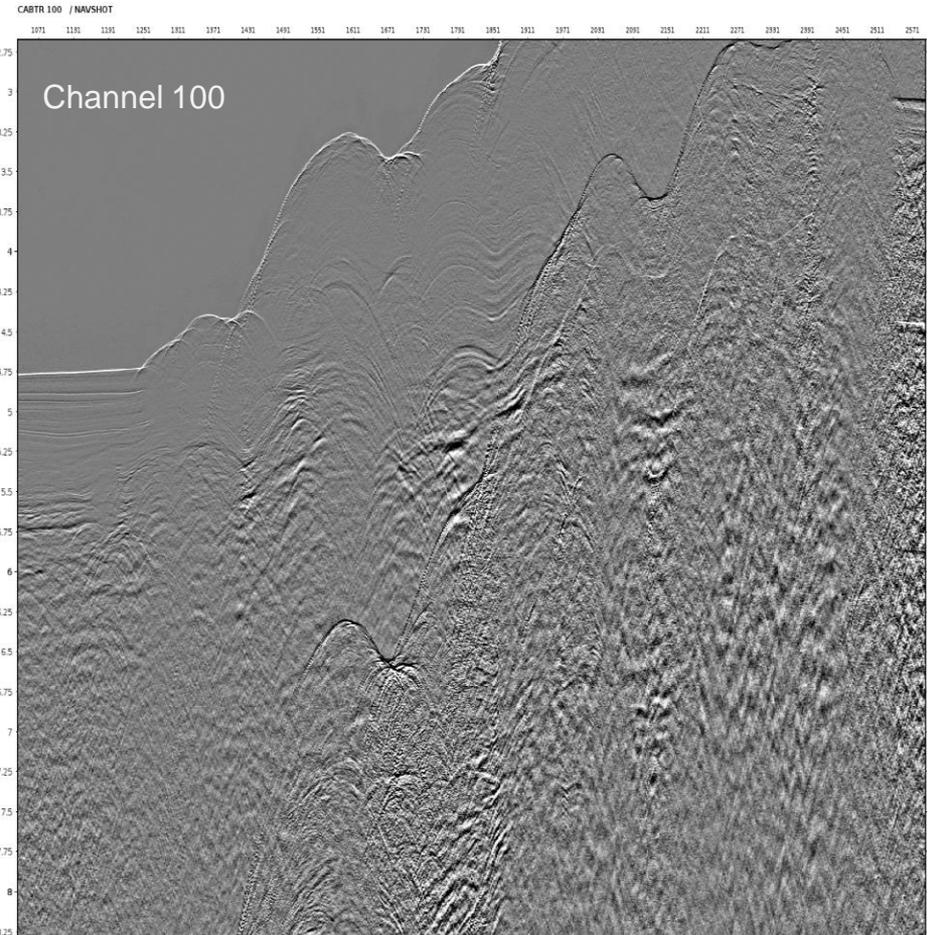
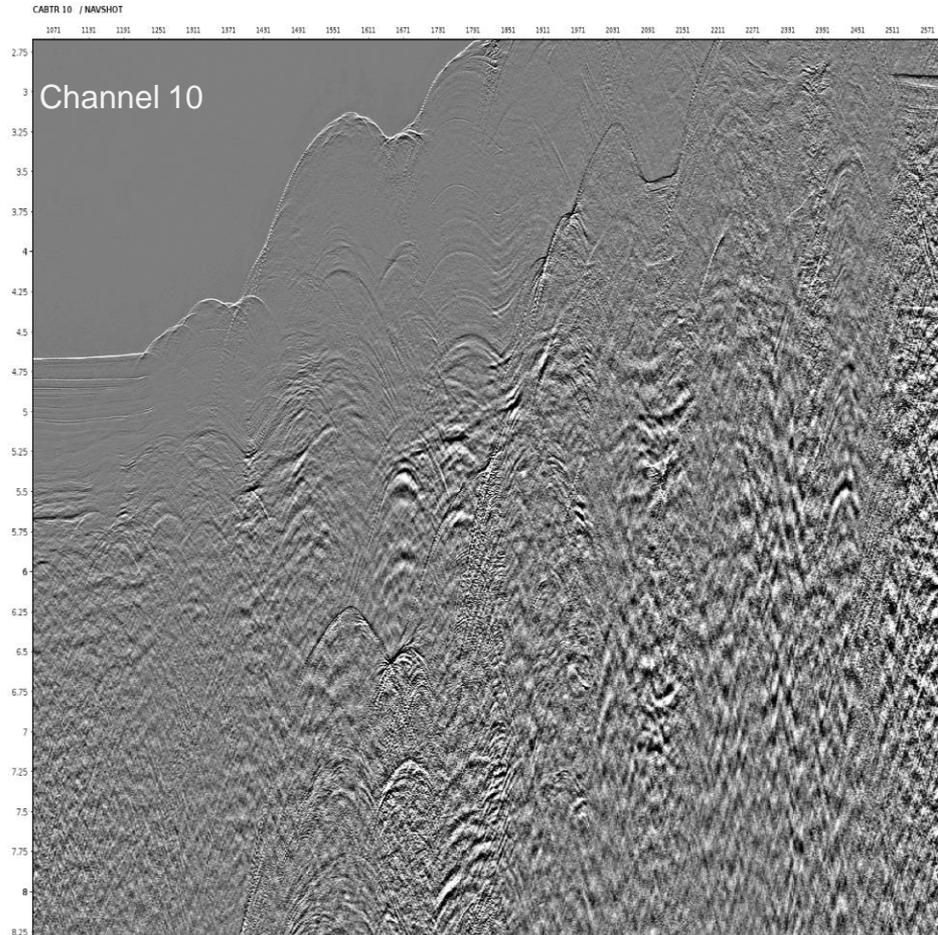


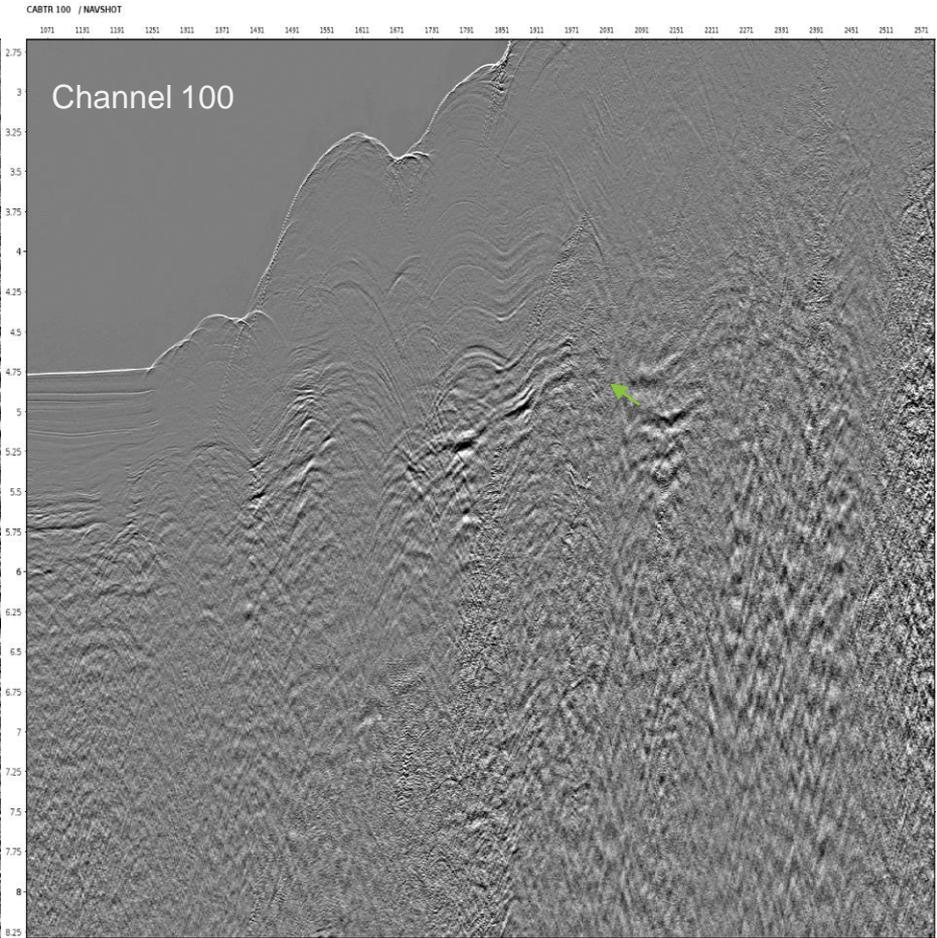
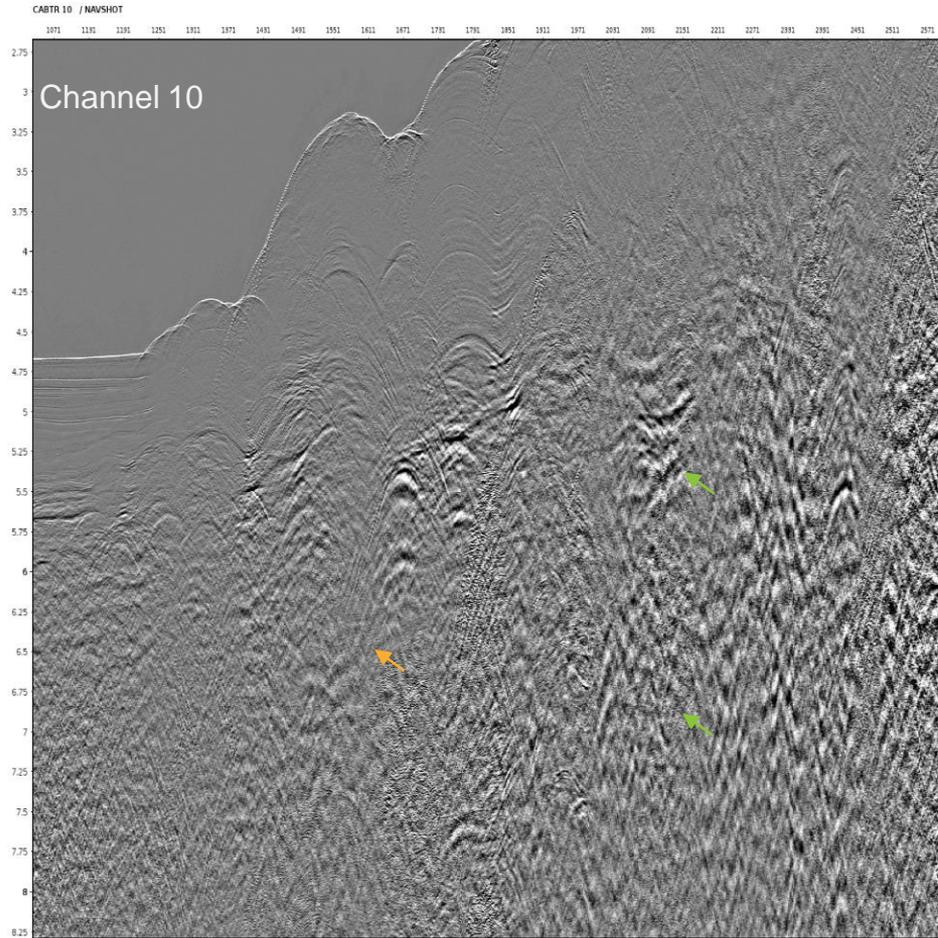
CABTR 10 / NAVSHOT



CABTR 100 / NAVSHOT

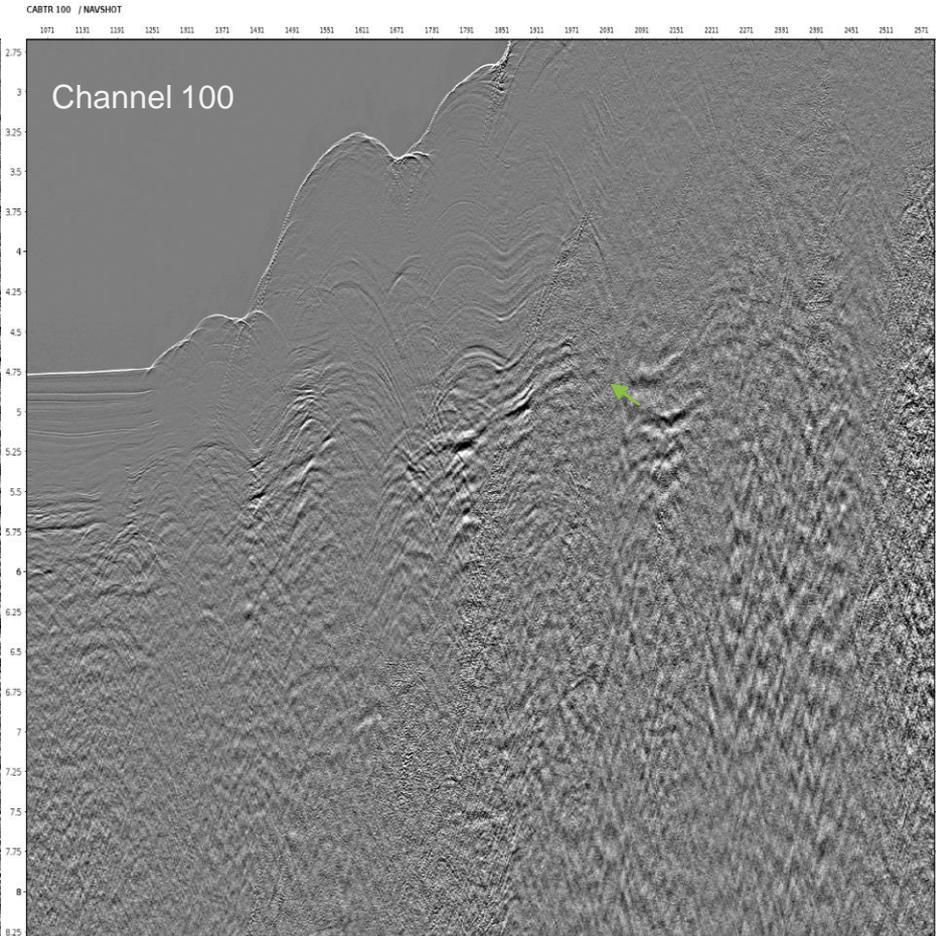
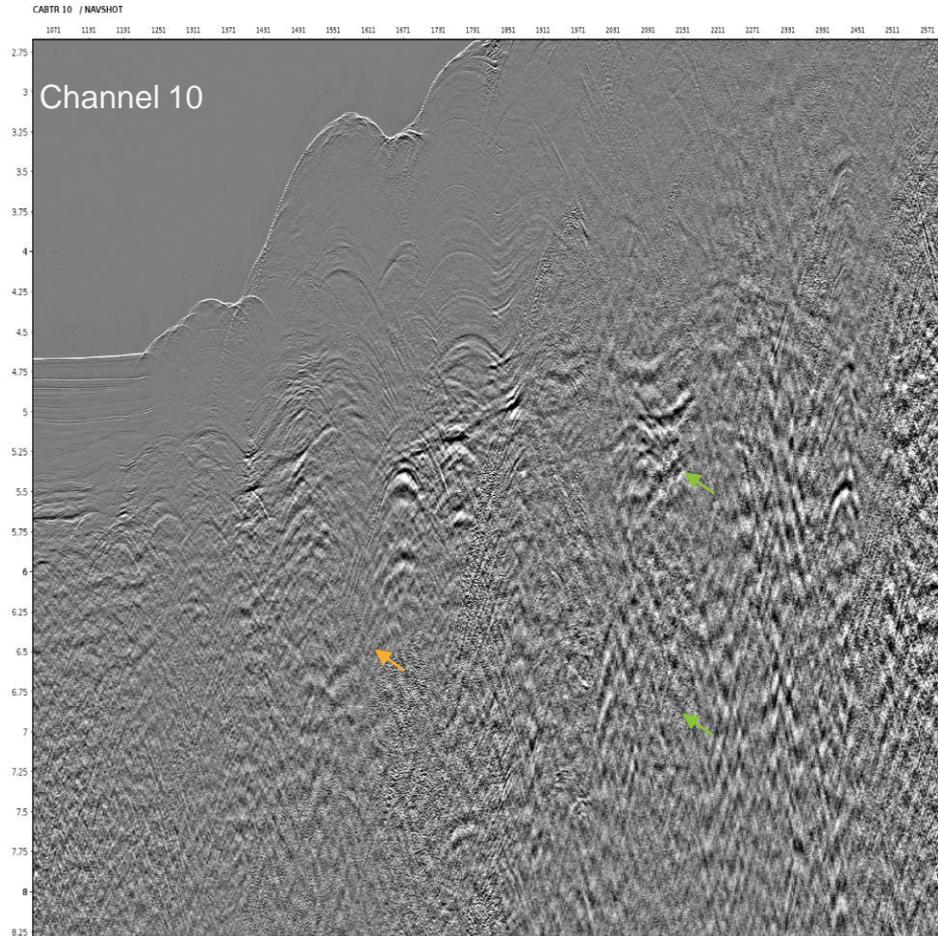




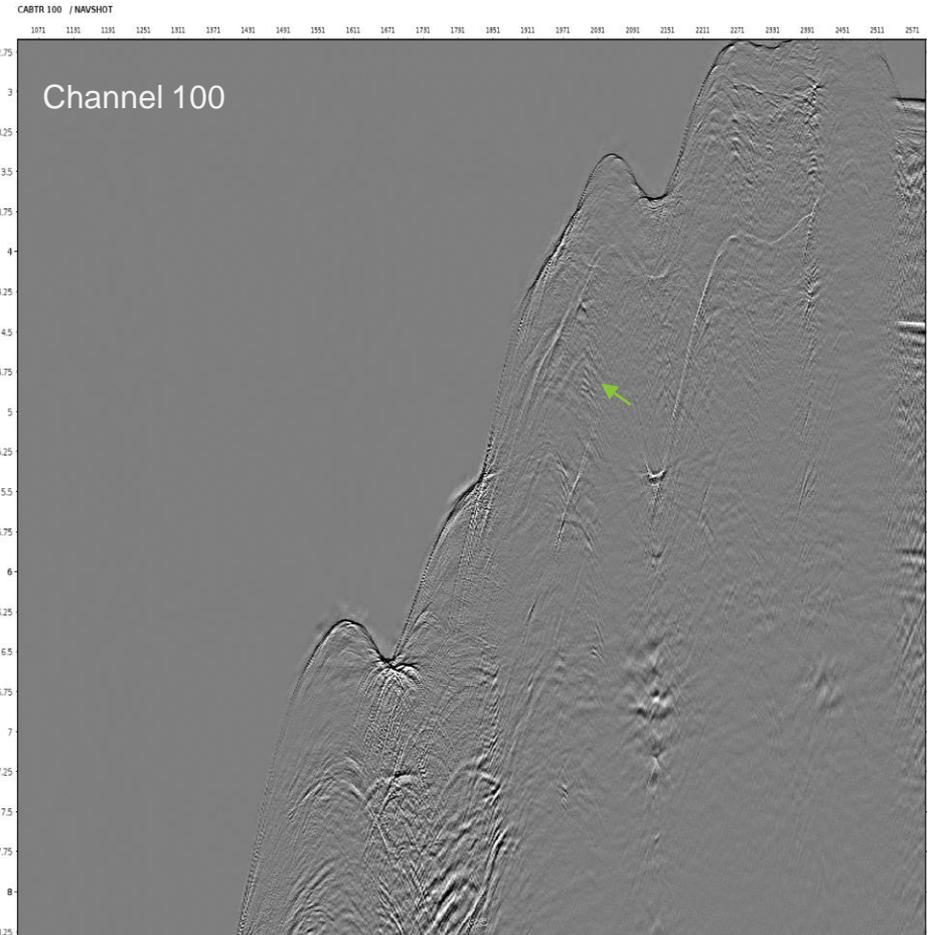
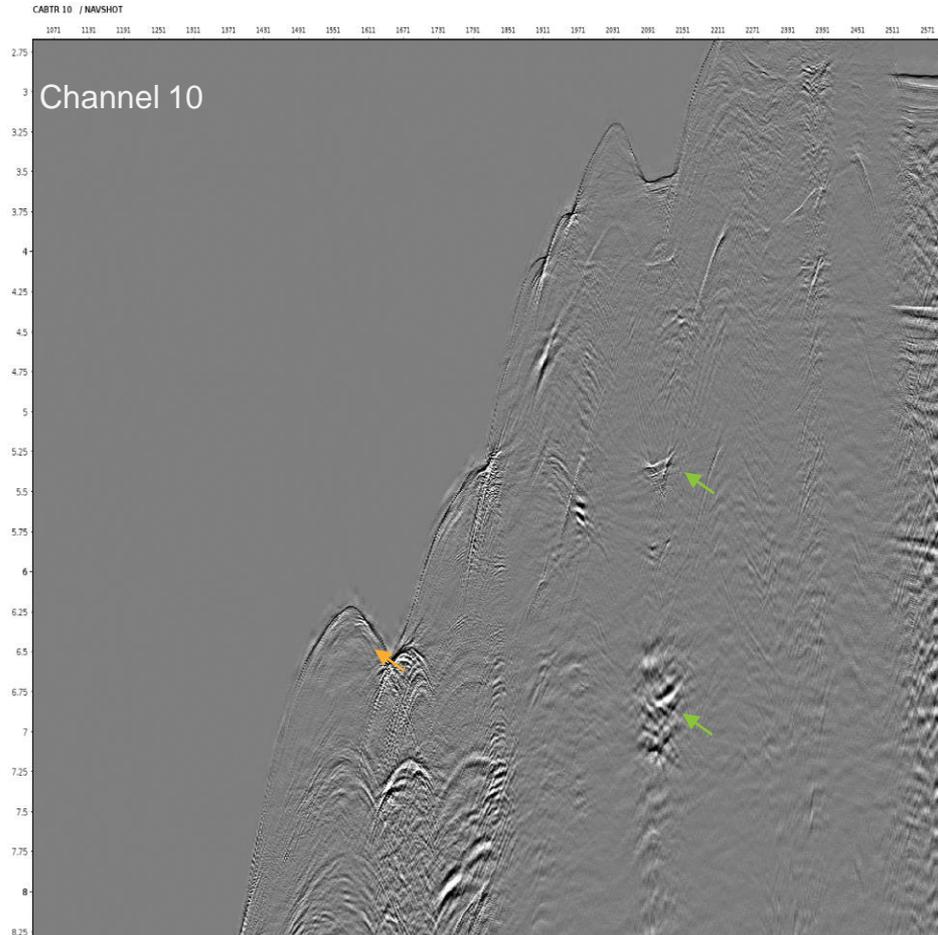




Common Channel **after** SRME & MWD Subtraction

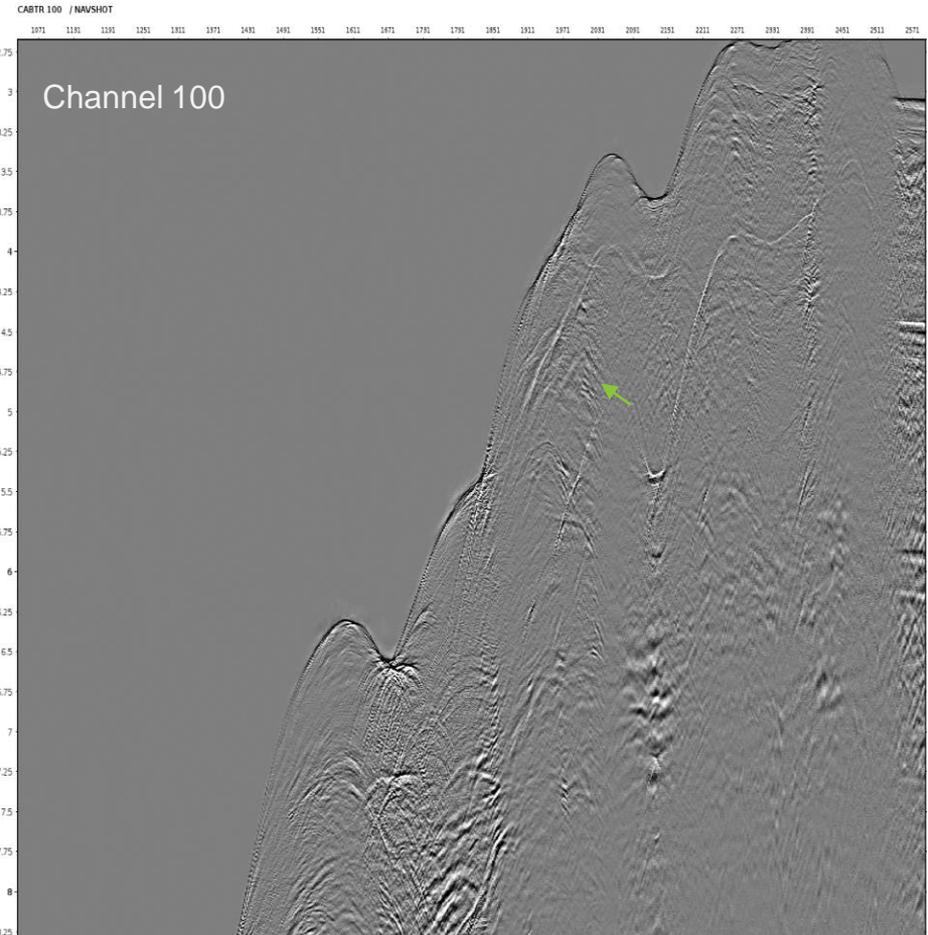
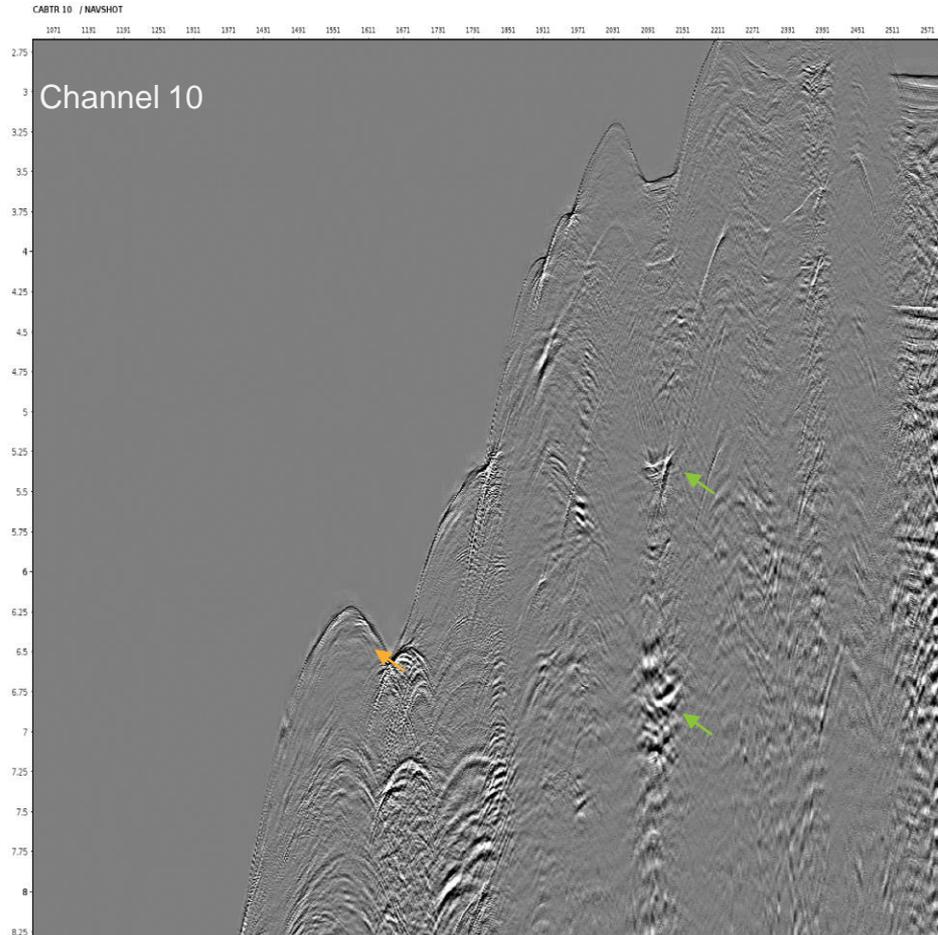


Difference before – after SRME Subtraction



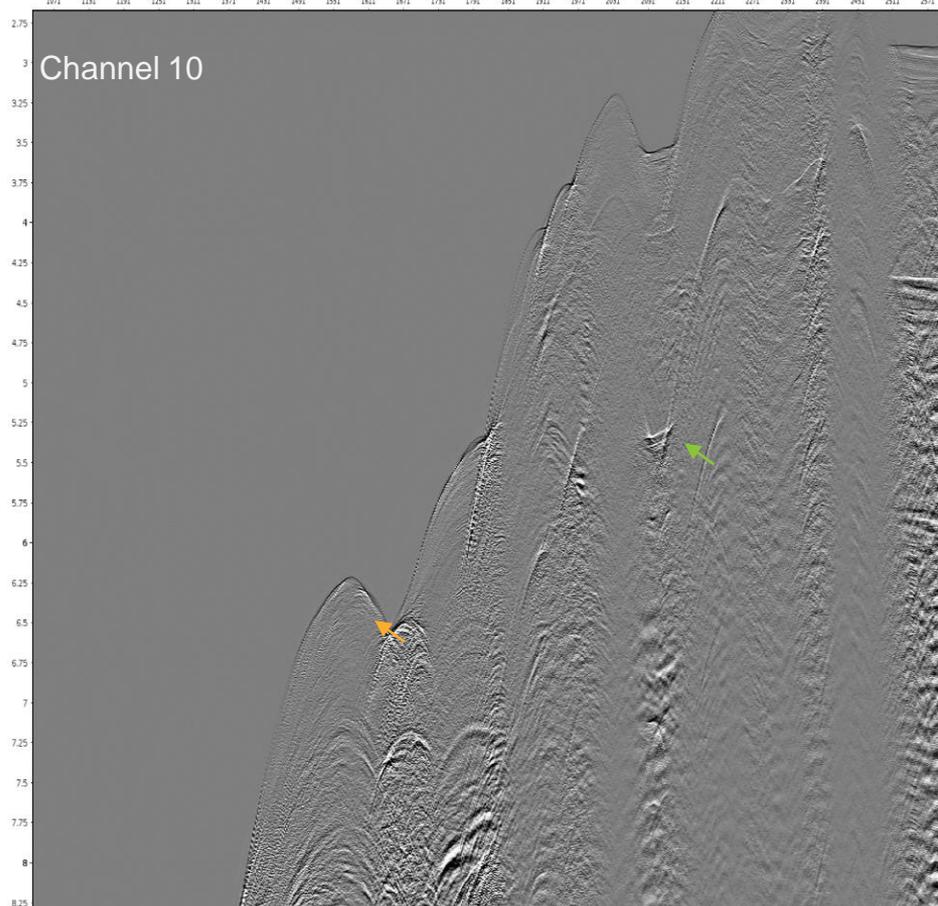


Difference before – after SRME & MWD Subtraction

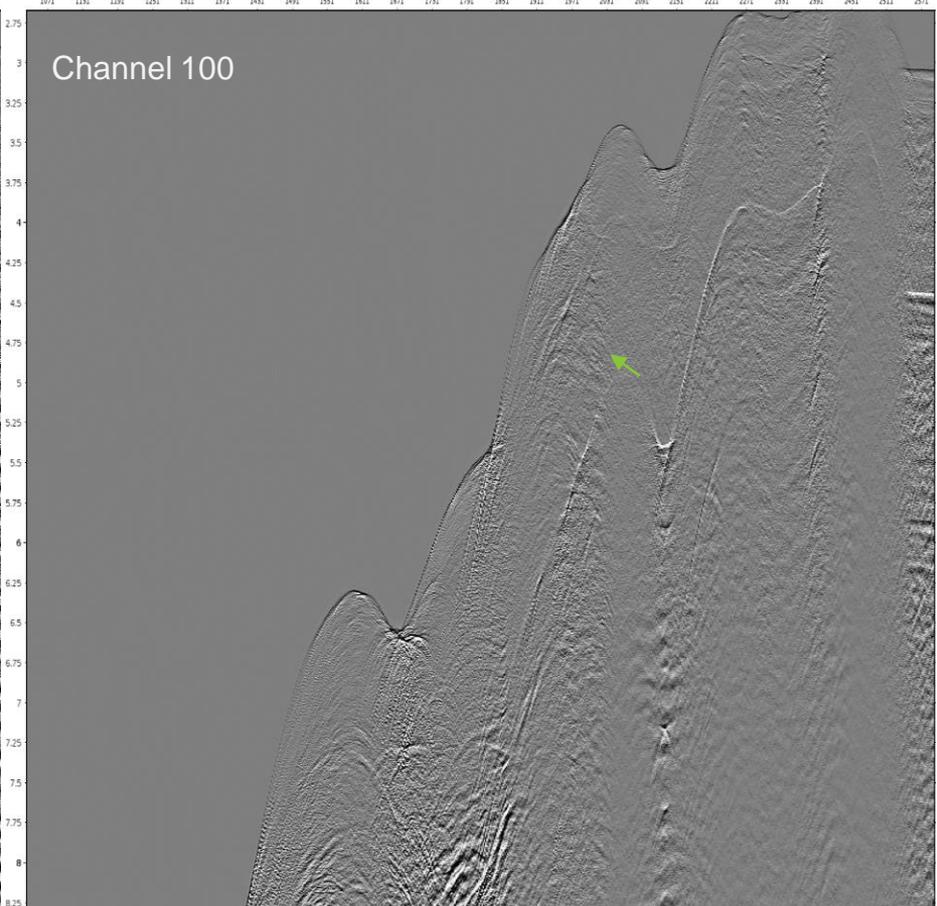


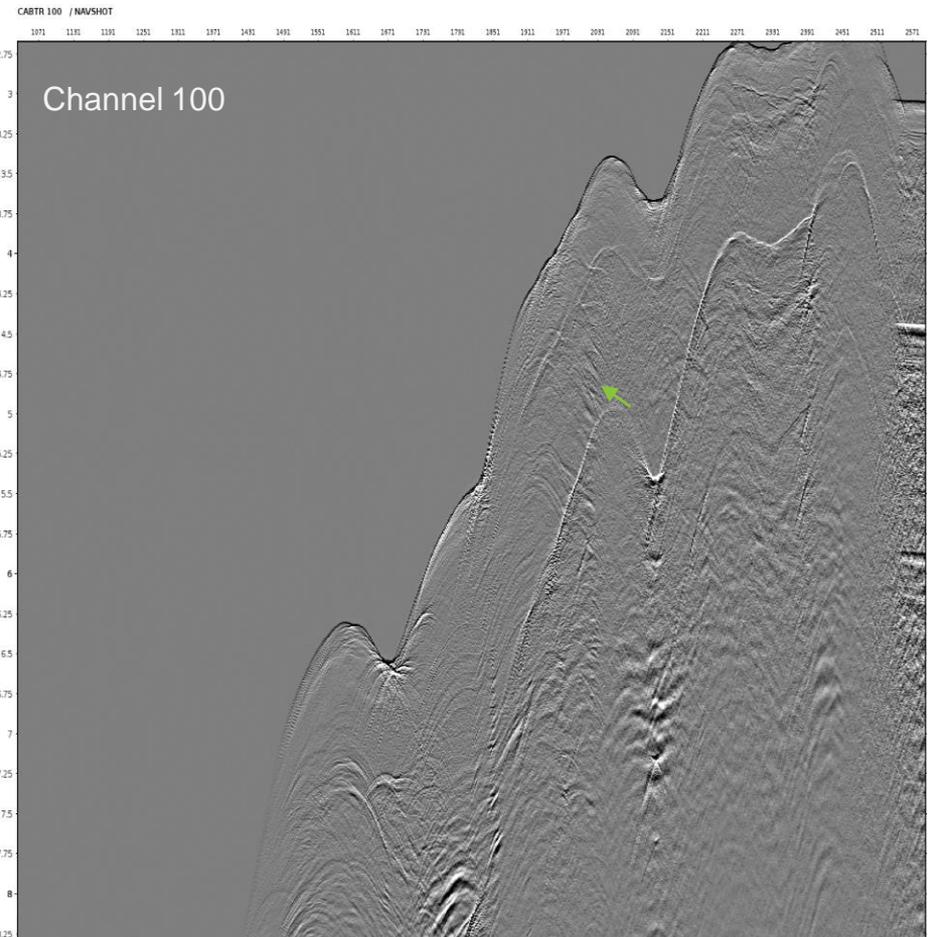
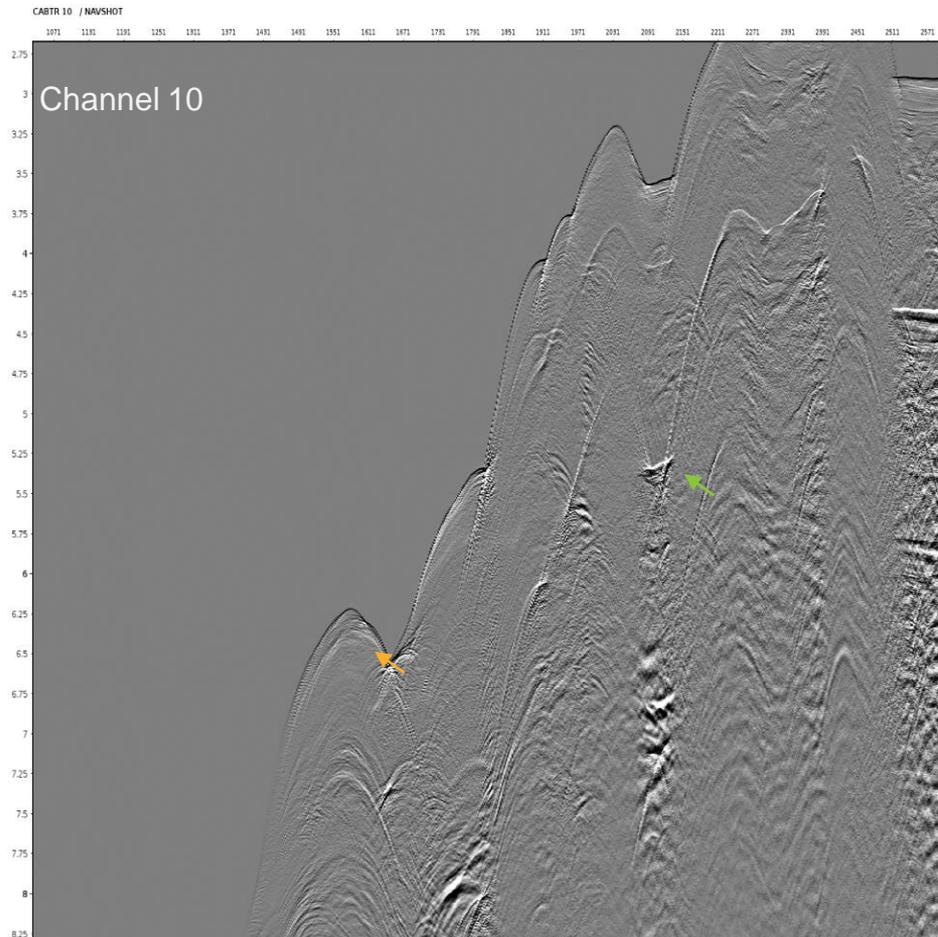


CABTR 10 / NAVSHOT



CABTR 100 / NAVSHOT





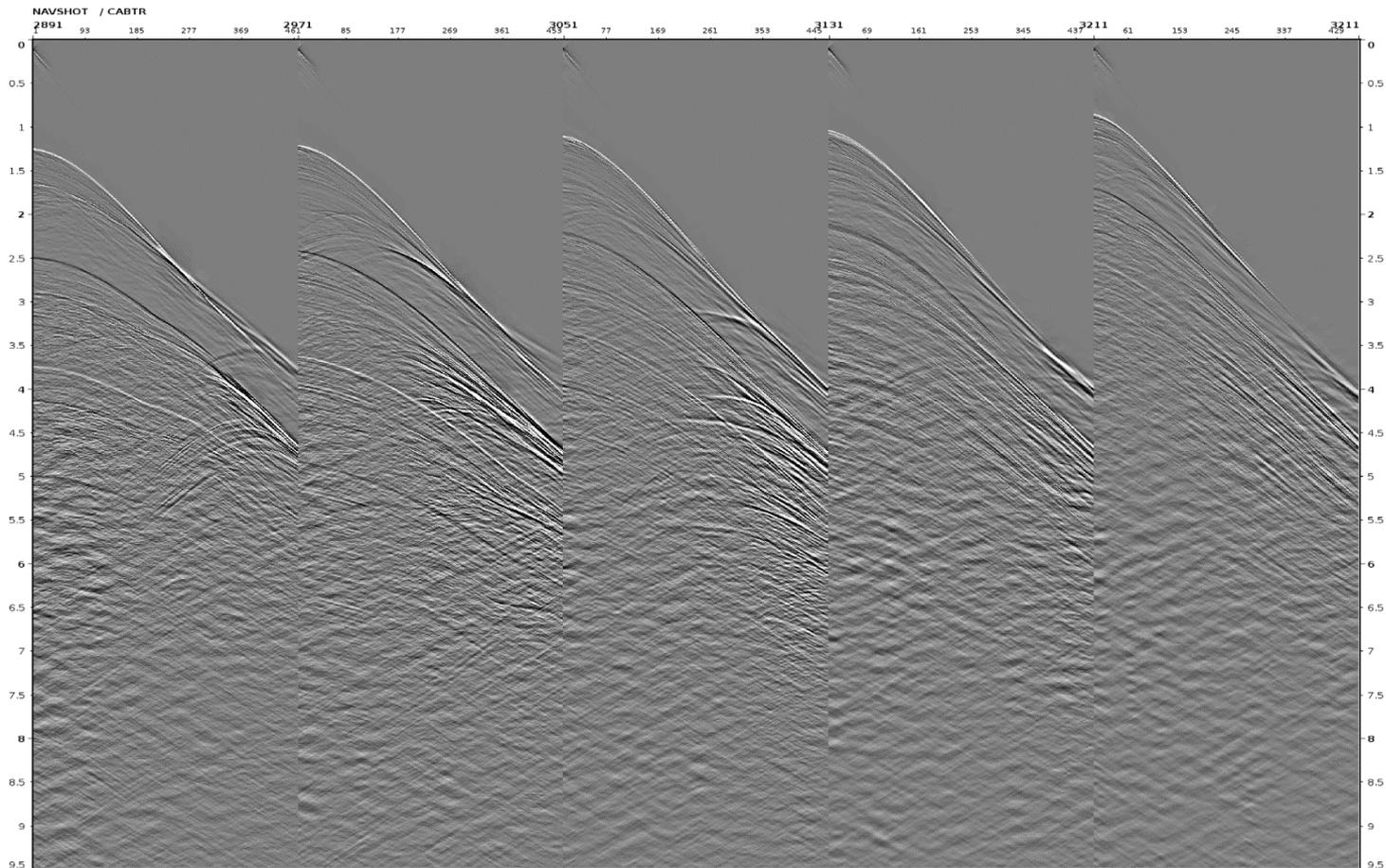
Seq 018

Stack

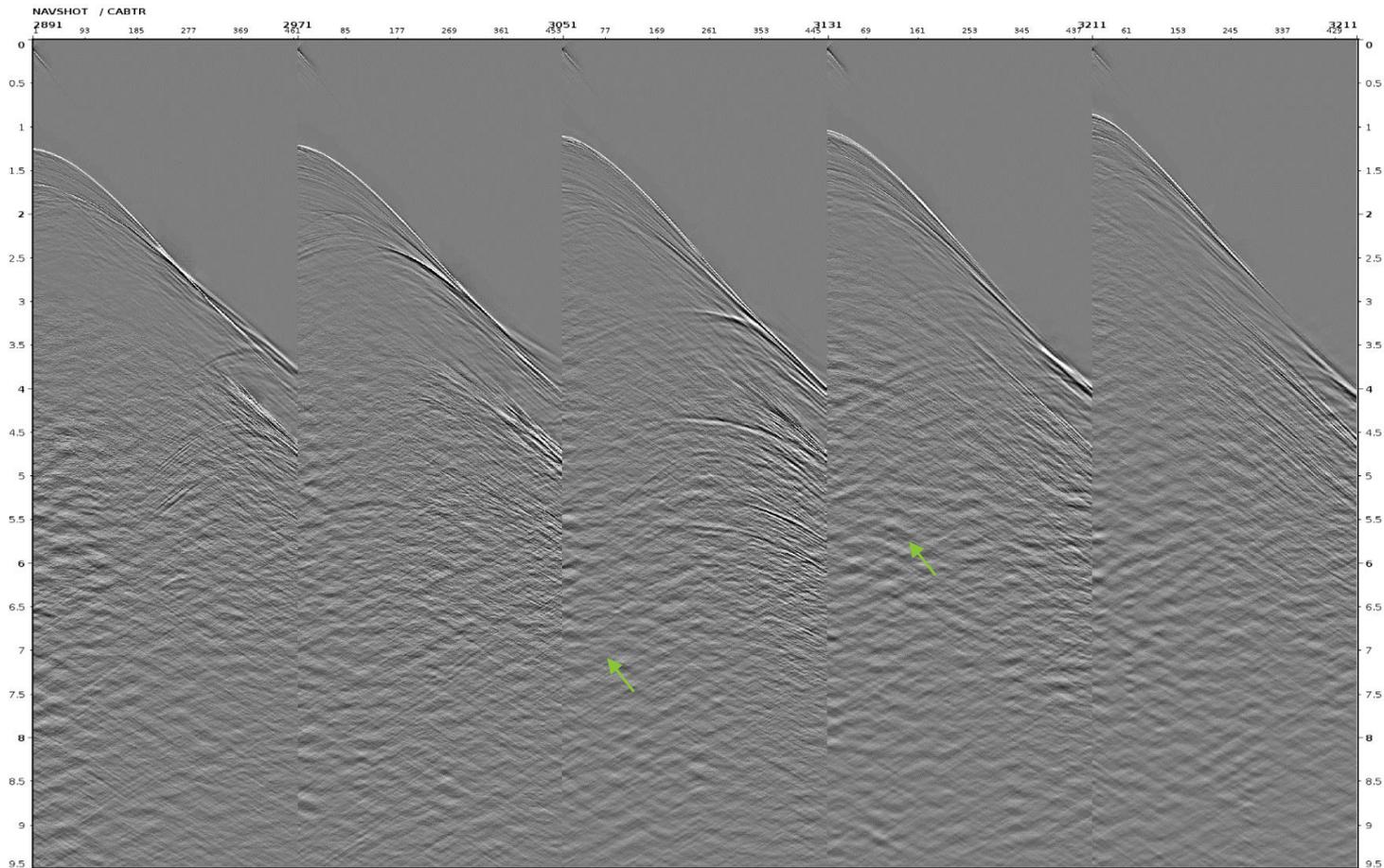
Common Channel

Shot Gathers





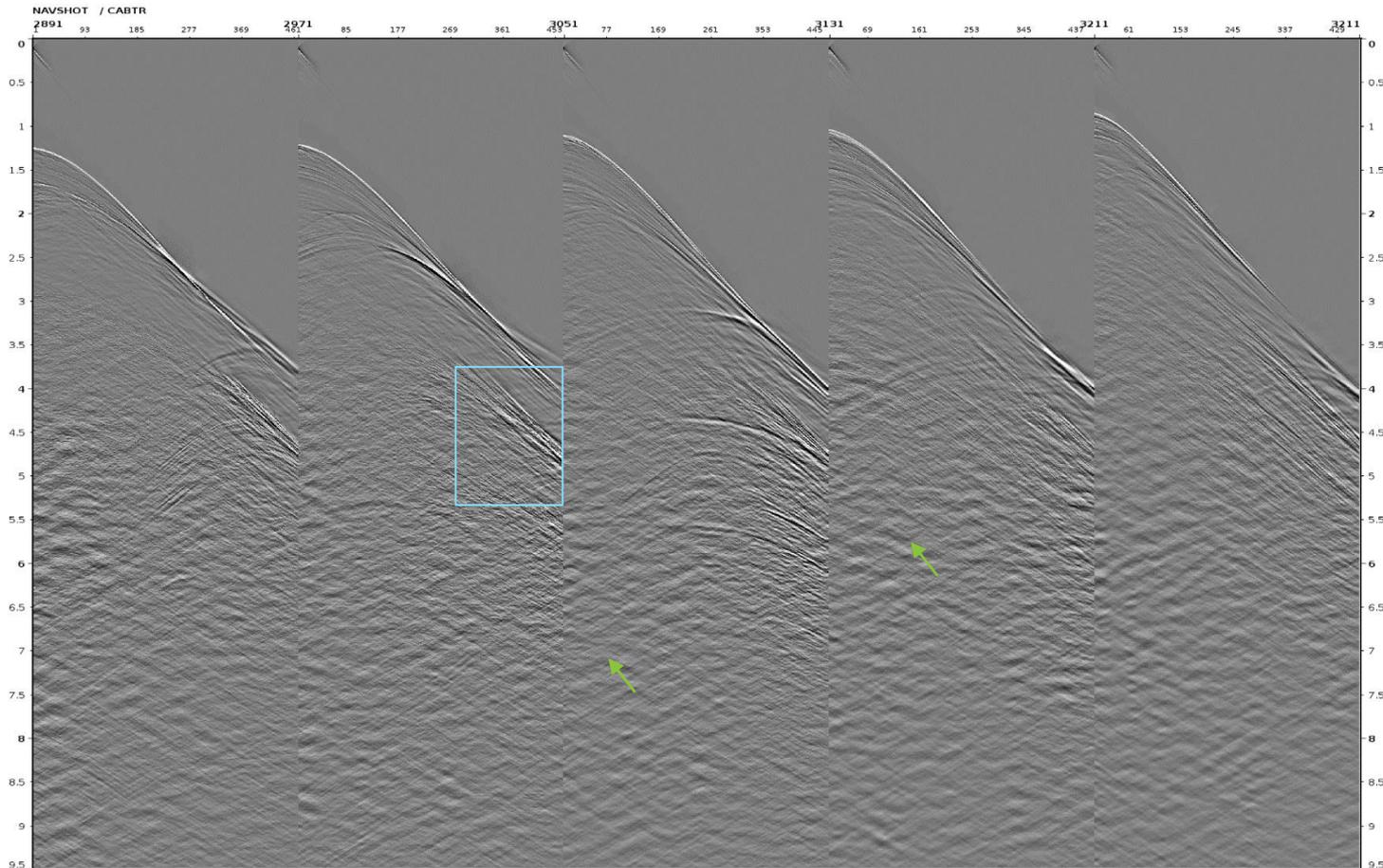
- Simultaneous subtraction flow with MWD & SRME shows benefits in surface related multiples removal and primaries protection.
- Far offset dipping residual will be further removed by “Radon” and residual LNA (Linear noise attenuation).



- Simultaneous subtraction flow with MWD & SRME shows benefits in surface related multiples removal and primaries protection.
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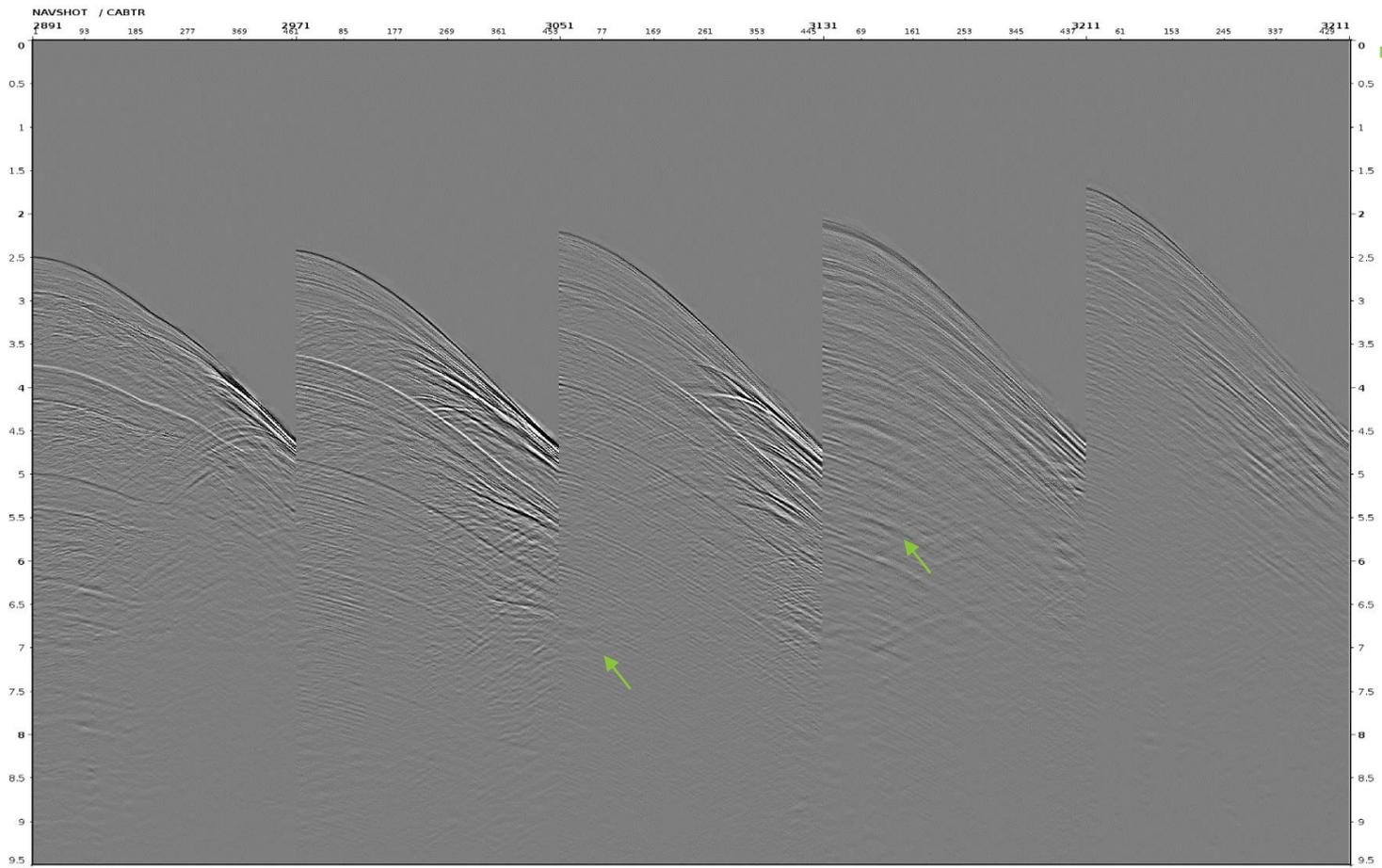


Selected Shots after SRME & MWD Subtraction

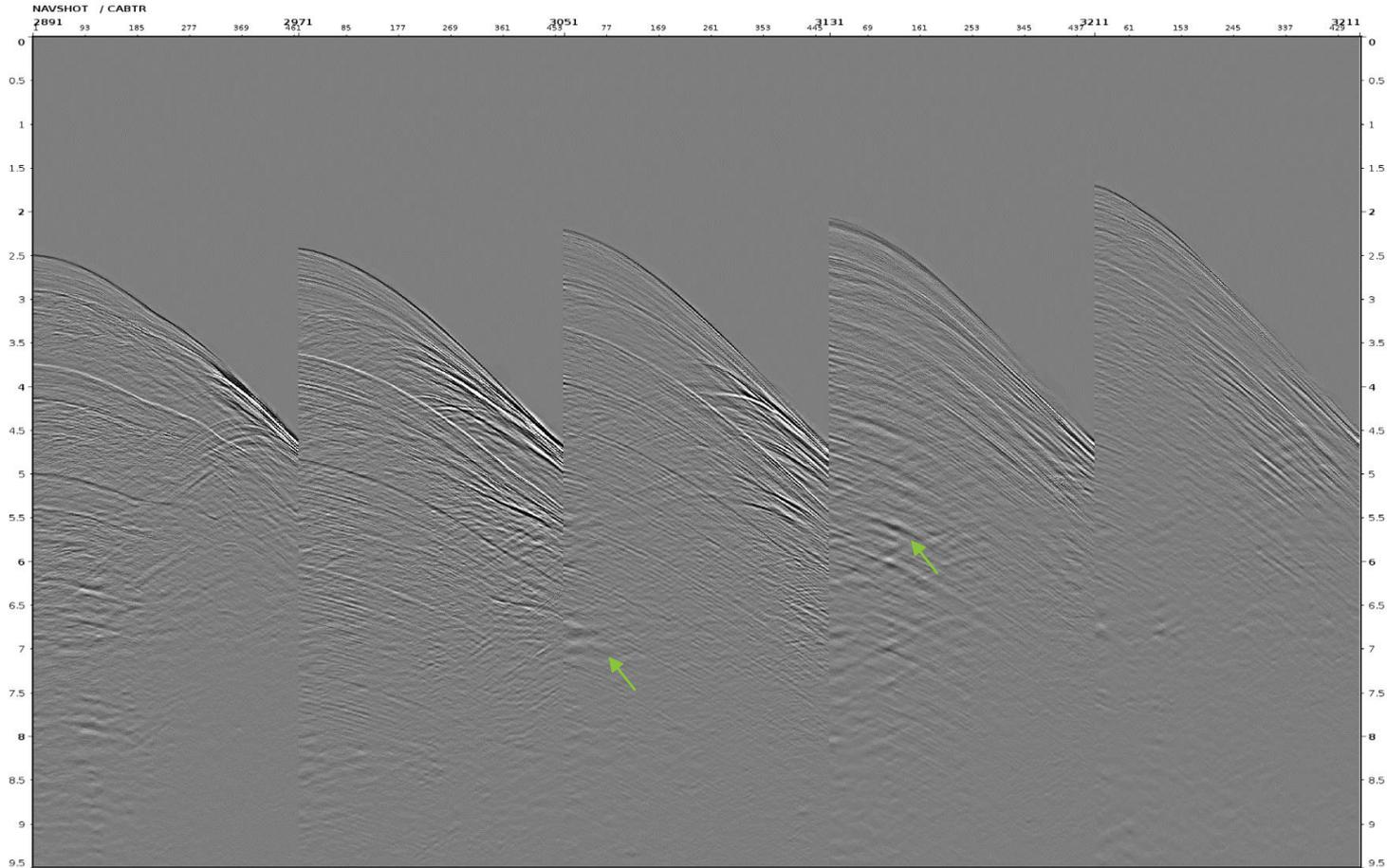


- Simultaneous subtraction flow with MWD & SRME shows benefits in surface related multiples removal and primaries protection.
- Far offset dipping residual will be further removed by “Radon” and residual LNA (Linear noise attenuation).

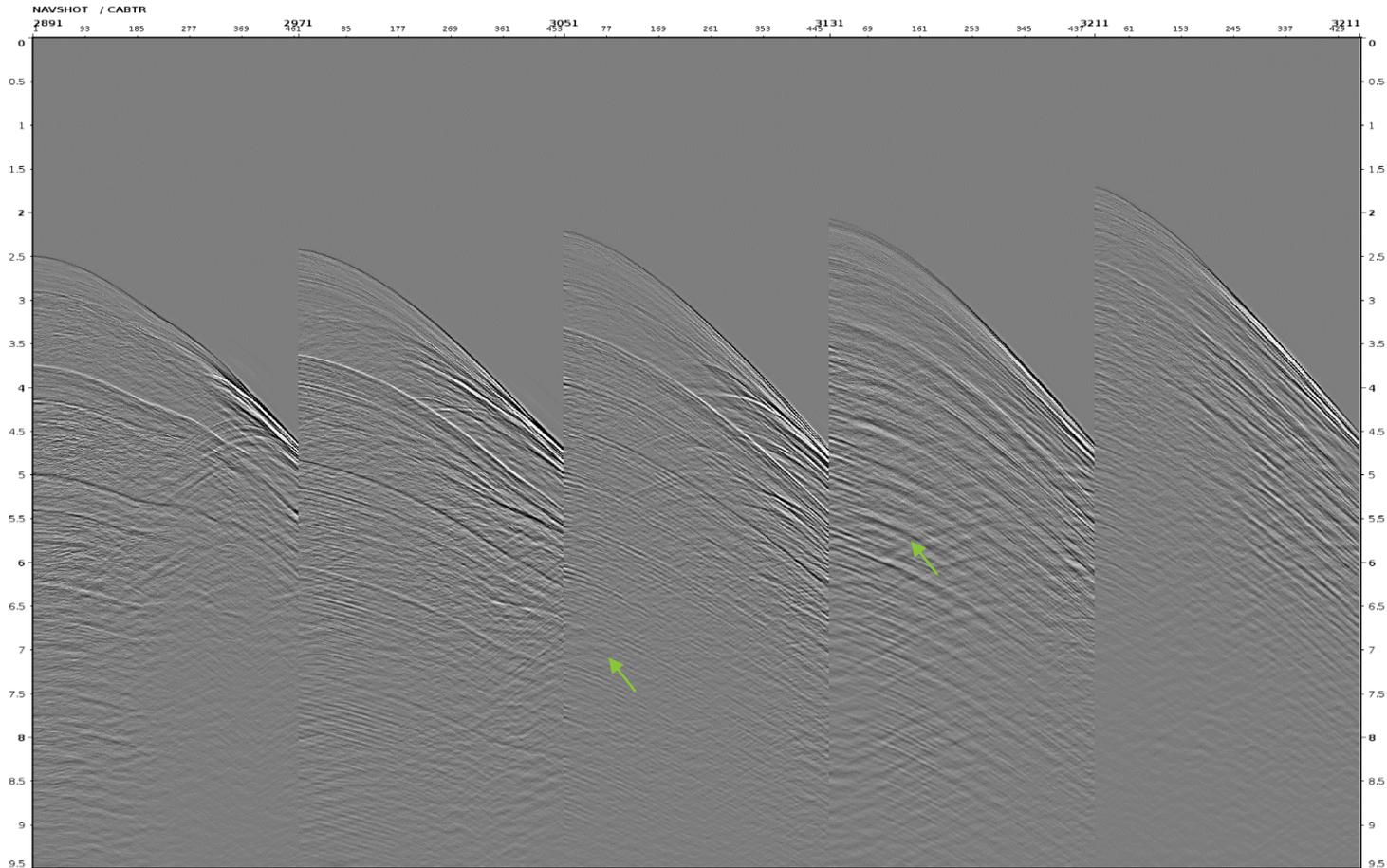
Difference before - after SRME Subtraction



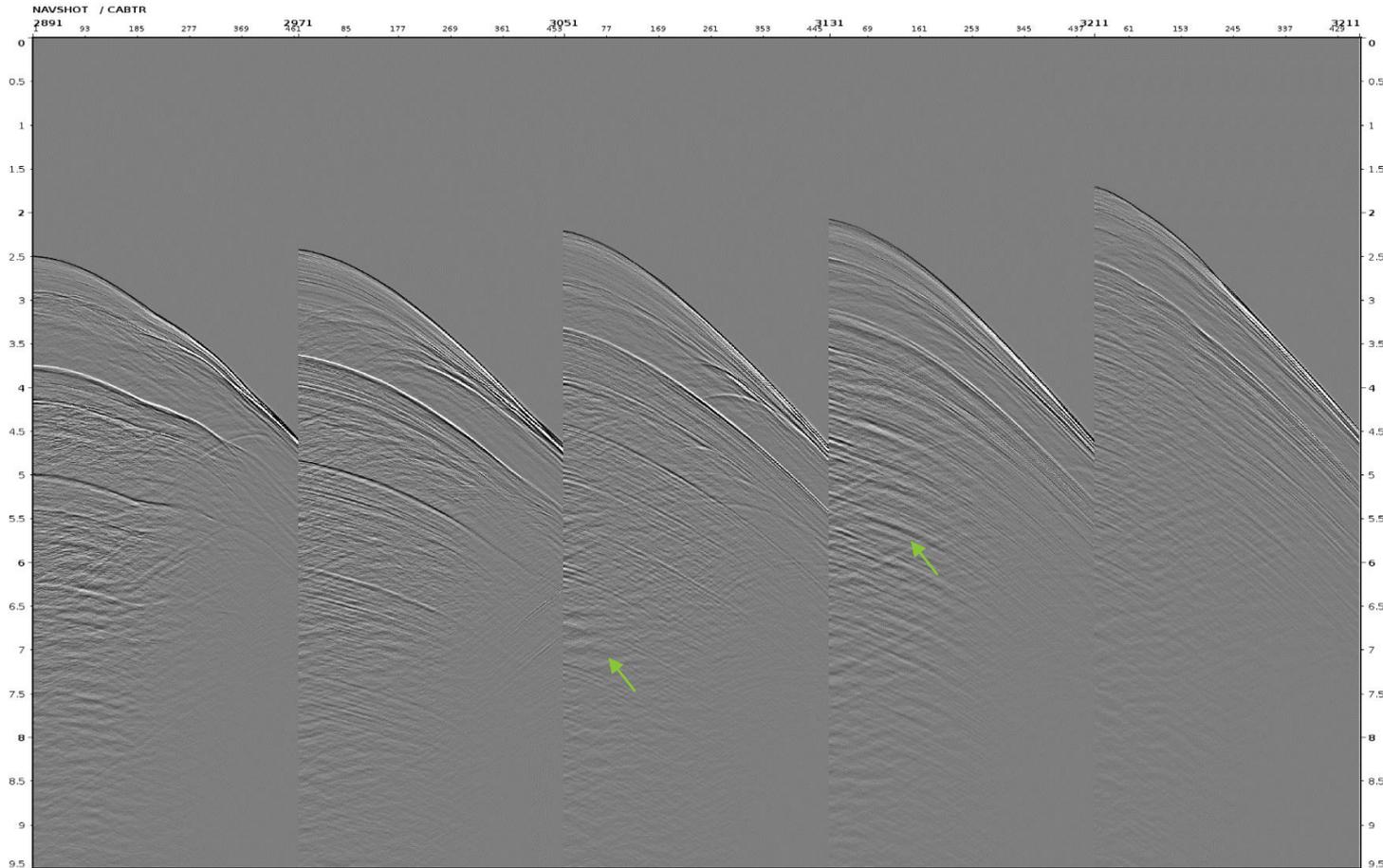
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- Simultaneous subtraction flow with MWD & SRME shows benefits in surface related multiples removal and primaries protection.

- Simultaneous subtraction is beneficial for multiple removal and primary protection. It's recommended to apply for production.